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FIRST AERO WEEKLY IN THE WORLD

NOV 15 1937

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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

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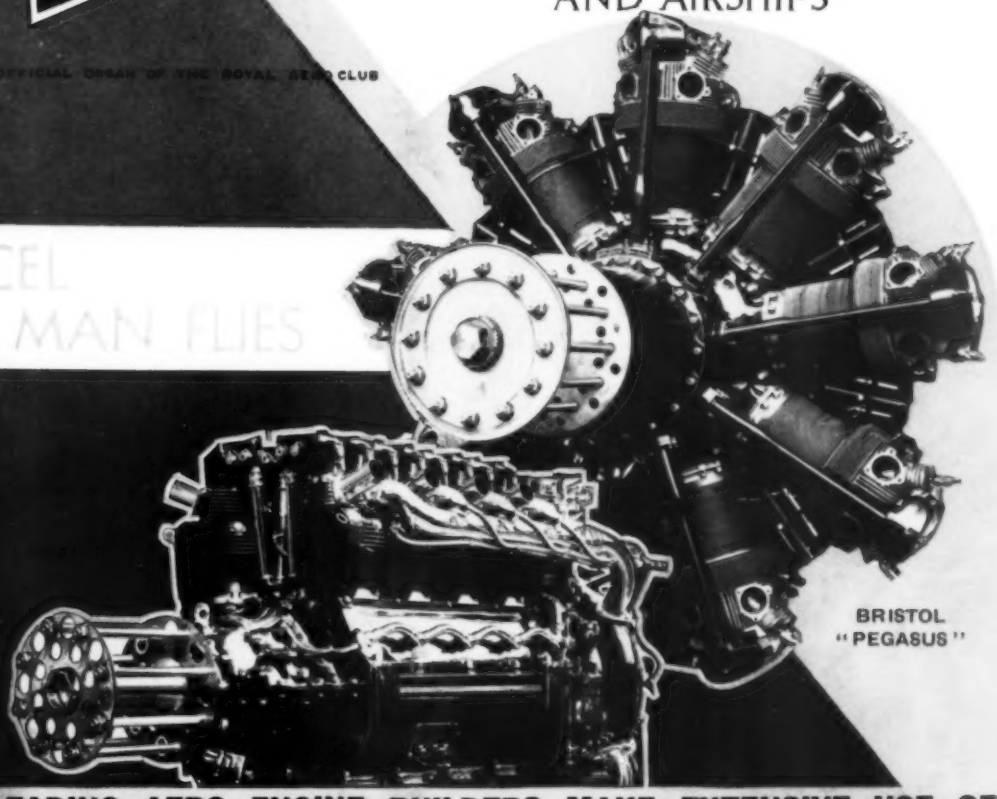

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"PEGASUS"

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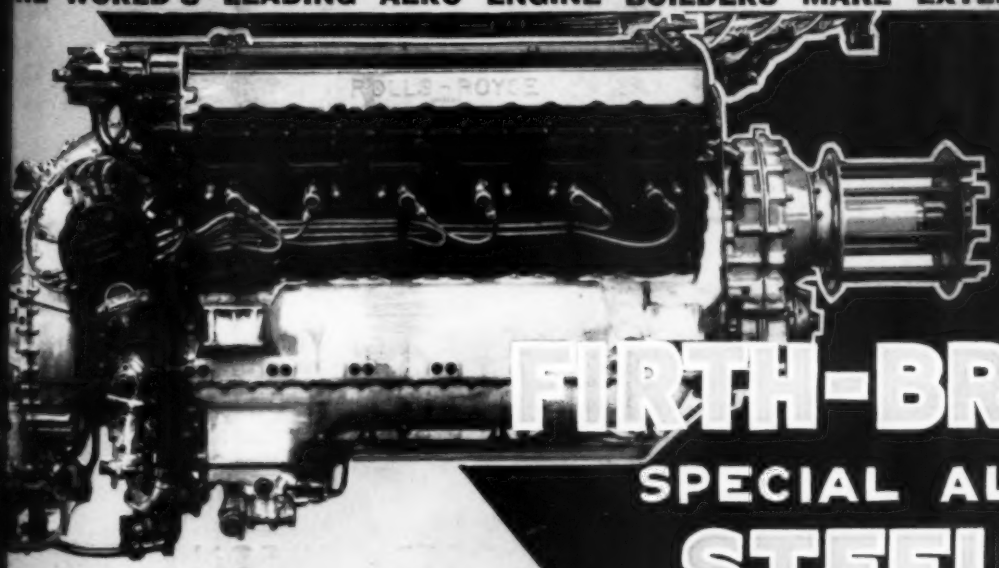

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The AIRCRAFT ENGINEER AND AIRSHIPS

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

A Public Affair

IT was quite inevitable that, unless the dispute was settled with reasonable promptitude, the affair of the Imperial Airways' dismissals would reach the public ear. In the House of Commons last week certain very awkward questions were asked and still more awkward statements made. The matter has become public property.

Imperial Airways probably had very good reasons for acting as they have done, and the Under-Secretary of State for Air probably had equally good reasons for being somewhat evasive in his replies. Even Mr. Woods Humphery's statement (given on p. 457) on behalf of Imperial Airways tends to skate over the real questions involved, while replying adequately to less important and certainly less accurate remarks made by Mr. W. R. Perkins, M.P., in a criticism of our national air-transport company which was not really germane to the argument.

It is more than a pity that this almost purely domestic quarrel should have become a subject of public debate and that this (possibly) soiled linen should have been washed so openly. Beyond all things, a national company such as Imperial Airways, depending as it does entirely on public confidence, must be above reproach. This open criticism is bound to do a very great deal of harm both here and abroad. The travelling public alone is not likely to be favourably impressed by remarks, however ill-advised, about dissatisfied pilots and inadequately equipped and obsolete machines.

Up to the present both the Air Ministry and Imperial Airways have been what can only be described as proudly uncommunicative. Whether they are right or wrong, an impression will remain that all is by no means as it should be.

Public enquiries into domestic troubles of this nature are not, as a general rule, to be recommended, and it appears that the demand for such an enquiry has, in fact, already been refused. Nevertheless, an unfortunate impression will remain unless something is done. Imperial Airways are subsidised and are, consequently, partly the property of the general public. In such circumstances an exception might be made and an impartial investigation held without delay.

The Guild's Attitude

MEANWHILE an editorial in the November issue of the *G.A.P.A.N. Journal* explains the Guild's attitude towards the new Association and the trend of recent events.

The writer is quite fair in his judgment. He makes the obvious point that a division of loyalties is a bad thing, leaves the pilot to decide whether he should support the Guild or the new Association, and reminds everyone that this Guild was, in fact, formed in 1926 after another "strike" of Imperial pilots.

"There is nothing . . . which prevents us," he says, "from empanelling a committee of pilots to deal with such important matters as rates of pay, hours of work, conditions of duties, and advice on the choice of the vessels we fly. . . . If we will begin in 1938 with an effort to make the Guild 100 per cent. strong we shall be armed with the voice of a collective authority to right the wrongs which alone have caused the Association to arise."

Those two sentences are in themselves an admission of failure and of the fact that there *are* wrongs to be righted. If the Guild had really provided what was needed it would have been 100 per cent. strong, and the new Association would never have been considered. Because the Guild did not attend to the wishes of its prospective members, these pilots formed their own organisation. If the present little troubles have no other repercussions, they will at least have given a number of people a much-needed jolt.

However, the tone of the editorial certainly suggests that full co-operation, at least, between the two bodies might be expected to produce results.

Substantial Shadows

FIELDS to factories in twelve months is a feat of which the "shadow scheme" firms which have co-operated with the Air Ministry may well be proud. That is the accomplishment of the five firms in Coventry and Birmingham whose works and achievements are described in a special article in this issue.

When the shadow factory scheme was first announced there were many who held the view that "it wouldn't work." They claimed that, to build something as delicate

as a modern aero engine, it was necessary to build the complete engines in each of the factories. *Flight* did not share that view, and pointed out that the A.I.D. inspection should be capable of ensuring that the scheme did work. It is too early to form an opinion, as none of the new factories has had time to produce sufficient quantities of "bits and pieces" to test the matter by the assembly of considerable numbers of complete shadow engines. But after an inspection of the production methods followed, we see no reason to believe that serious difficulties need be feared when it comes to marrying together the components made by one factory and those made at another.

From the air armament point of view there is good cause to be satisfied with the almost phenomenal progress made. The factories are ready to begin work in real earnest, and the output which it is expected to reach in a few months should ensure adequate deliveries of engines.

The success of the whole scheme depends upon an extensive use of special jigs and tools, so planned that not only is really high-quality work possible but indeed inevitable. The stages in manufacture are so organised that when a part is finished it is as near perfect as human effort can make it, or it will have been scrapped before reaching the finished stage.

Not the least gratifying aspect of the shadow scheme is the way in which everyone concerned has worked together for the good of the common goal: laboratory quality on a quantity production scale. Individual firms would, in some cases, have preferred to build complete engines, but they realised that large production was only to be obtained by the other method. From the national point of view there is reassurance in the multiplication of sources of supply which the shadow scheme implies.

Catapult or—

THE idea that some form of assisted take-off is the next big development has now become widespread, although the view is by no means universally accepted. For instance, *Flight* discussed the matter the other day with a famous flying-boat test pilot, and in his opinion the trend of development is that boats are becoming easier to take off and a little more difficult to land in spite of the rapid increase in wing loadings, so that the take-off problem is at least keeping pace with development.

Although ultimately heavily loaded aircraft may be able to take off under their own power, it seems to us likely that before that happy state is reached we shall go through a sort of assisted take-off period, during which wing loadings of 50 lb./sq. ft. will become quite common. The question, then, is which form of assisted take off is most likely to give the best solution.

Three general types have been suggested: The catapult, the starting rail and the composite aircraft. The catapult has the advantage of having been in use for many years and has definitely proved itself, particularly on board ships. The starting rail, of which Capt. Frank Courtney is an enthusiastic advocate, is doubtless quite feasible from a technical point of view, the "weathercock stability" imparted by the special carriage making it unnecessary to have the rails strictly parallel with the wind direction. The composite is just about to be tried, and will in all probability be found to offer a very good solution when it is a case of getting a relatively small but heavily loaded aircraft into the air with the help of a much larger but lightly loaded one.

Frequency of launch will be of immense importance from the military point of view, and in this respect the catapult probably scores, with the starting rail and composite aircraft approximately level for second place. Mobility is another vital factor, and here the composite must occupy first place, with the ship-borne catapult second and the starting rail nowhere. (To this Capt. Courtney will doubtless reply that the Royal Engineers can jolly soon lay down a mile and a half of rails anywhere.)

—Air Tug?

WHEN one comes to analyse the position in a little more detail, it emerges that what we really want to get into the air is the *large* heavily loaded type of aircraft, be it civil or military, landplane or flying boat. "The greatest possible load transported the longest possible distance" is the object.

It seems just a little strange that no one appears to have considered the simple towing method. Getting gliders into the air by towing them behind an aeroplane works very well. Why should not the same general idea be applied to heavy aircraft?

The objections are fairly obvious; but there were many objections to the catapult, yet they have been overcome. When applied to large aeroplanes, the towed start implies a very large aerodrome and, moreover, one with a very smooth surface throughout if starts in all directions are to be possible. On the sea, however, the same objection does not seem to apply. In almost any part of the British Empire there are large areas of fairly sheltered water from which heavily loaded flying boats could take off.

One may imagine that the long heavy towing cable would present certain difficulties, but, bearing in mind that towed starts would not be made in a rough sea, they should not be insuperable.

What makes the idea of towed starts attractive from the flying-boat point of view is that the greatest power is needed to get the machine over the "hump" speed. Now it so happens that in all normal flying boats the hump speed is approximately one-half of the take-off speed. In other words, the "tug" would have to be capable of some 55-60 m.p.h. One can imagine some form of surface craft of light construction capable of a good deal more than this, so that at the hump speed it would have a substantial excess of power wherewith to help the flying boat off. Alternatively, it might be a flying boat similar to the towed one, but carrying no load, in which case its hump speed would be below that of the heavy boat. A certain amount of research would be needed, but the advantages are so obvious that this should be well worth while. Mobility and frequency of start should both be of a high order.

Towards the Ideal

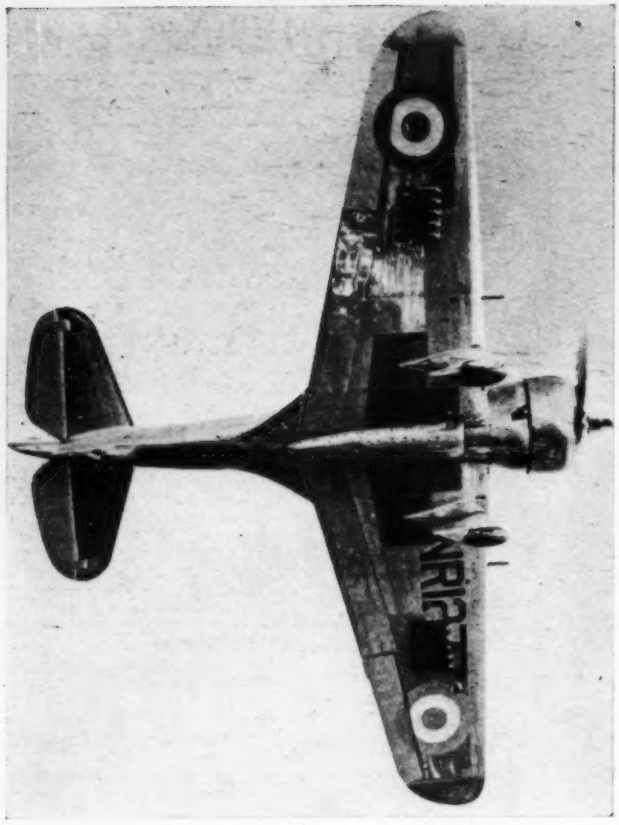
WHEN the Gloster company produced the Gauntlet some years ago, with a top speed of 230 m.p.h., the Air Ministry placed an order, but openly stated that this excellent aeroplane was to be regarded only as an interim replacement for some of the fighter squadrons. The still better Gladiator is regarded in the same way. Since then at least two types of fighter have been produced which seem to satisfy requirements for the time being, and which will stand comparison, and a bit more, with any foreign fighter aeroplane. In the new class of medium bomber Britain is also in a very happy position, for a number of really good types are now rapidly coming into use by the squadrons.

The time has not yet come when the heavy bomber can be disregarded, although some authorities seem to think that the future in air warfare lies with the medium bomber. For the present, however, we must use every endeavour to get types of heavy bomber which will be able to play their part in modern air operations. We are putting into service some very sound machines, wonderful pieces of engineering skill, most of which have a top speed round about 200 m.p.h. These types must be regarded as interim replacements. Our next object must be (and probably already is, if one knew all that is working in the minds of the Air Ministry) a class of heavy bomber with a cruising speed of well over 200 m.p.h. Doubtless we shall get that design before long, though production is likely to limp some way behind design. Yet even that speed cannot be looked upon as good enough for British needs, and it is time to think in terms of 250 m.p.h. for the heavy section of the R.A.F. That is about the cruising speed at which bombers will be really useful.

DIARY OF FORTHCOMING EVENTS—PAGE 452

UP to be SHOT AT : OUR LATEST TARGET CRAFT

One of the first aerial photographs of the Airspeed Queen Wasp wireless-controlled target for anti-aircraft guns. Rapidly convertible into a seaplane, the Queen Wasp is of wooden construction and is fitted with a 355 h.p. Siddeley Cheetah IX radial. Dimensions as a landplane are : span 31 ft., length 26 ft. 4in. and height 8 ft. 9 in. The Queen Wasp made her first public appearance at the Royal Air Force display.



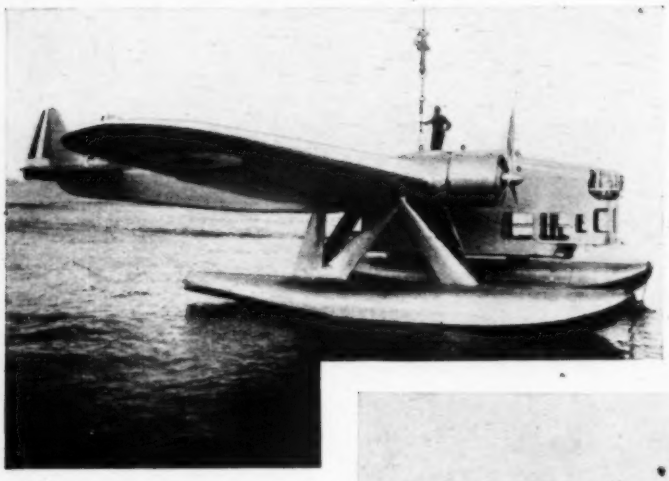
THEY DO

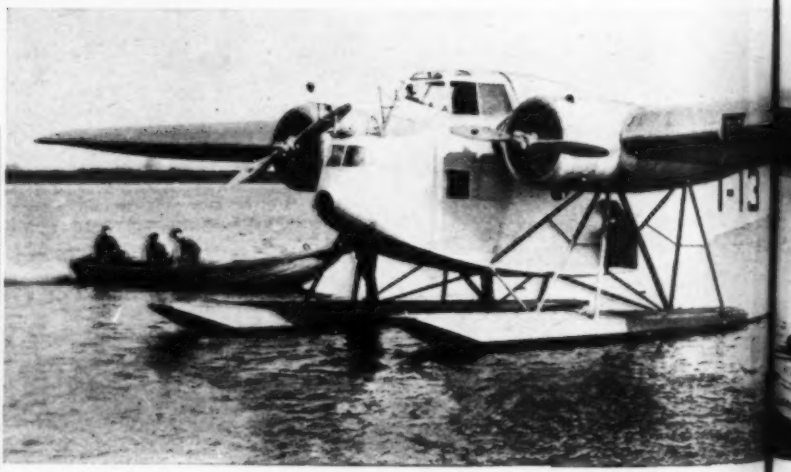
A Pot-Pourri of Unfamiliar Machines and Methods

ON the whole, international practice in the design, construction and utilisation of aircraft is fairly stereotyped, but now and again one comes across examples of countries having pursued certain lines of development and being accustomed to ideas which, to ourselves, seem decidedly foreign. A few of these instances, chosen more or less at random, are illustrated herewith.

The Curtiss Hawk 75 single-seater, shown on the top left-hand side of this page, is a little strange to us for a number of reasons. In the first place, the makers have retained the type-name Hawk for a stressed-skin monoplane, despite the fact that it originally applied to a wire-braced biplane. Then, again, the machine has been developed not only as a single-seater multi-gun fighter, but may be equipped with the necessary armament and tankage for medium-range bombing or attack work. A 350-lb. bomb load may be accommodated. The fitting of the Wright Cyclone G is analogous to specifying a Pegasus XX for a Gladiator.

The two large twin-float seaplanes are





The Curtiss Hawk 75 single-seater (top) can be equipped to carry quite a formidable bomb load, half of which is seen in the top right-hand photograph. The bombs are of the fragmentation variety.

Both intended for similar duties (bombing, reconnaissance and patrol), operating from comparatively sheltered waters, the Amiot (above) and Fokker T.4 twin-float seaplanes (right) are worth comparing. The Fokker, of course, is the older design.

likewise outlandish to our way of thinking. France, Italy and Holland have obtained some encouraging results from such machines which suit peculiar economical and operational conditions in those countries. Italy, in particular, has developed the multi-engined floatplane to a high pitch of perfection, the Cant. monoplanes having broken an impressive string of world's records.

Let it not be thought, however, that British designers have overlooked the possibilities of large floatplanes. Not many years ago Shorts built the Valetta, a triple-Jupiter high-wing transport, in landplane and floatplane forms. It afforded a useful comparison with the Calcutta flying boat.

The Northrop attack machine (a class never developed in this country) in the top right-hand view is seen equipped with containers beneath its wings for "chemical dispensation," as the Americans so aptly put it. Other

DIFFERENTLY

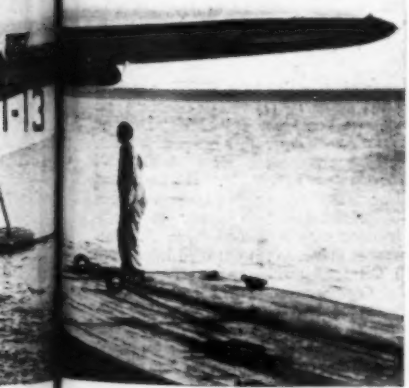
countries, though acknowledging the fact that their air forces are trained in the use of gas, seldom, if ever, make much of the fact in manœuvres. Gas, to them, is rather a skeleton in the cupboard. But America is quite open about it all.

An attack machine worth special study is the Curtiss Y1A-18 in small-scale production for the U.S. Army Air Corps. The "attack ship," to give it its common national designation, hitherto, has been a single-engined machine, as typified by the Northrop already illustrated, and the Y1A-18 is the first of its line. The R.A.F. does not recognise specialised attack machines. "Attack" (assault, ground strafing, or contact patrol) demands a machine with a high performance at low altitudes, heavy machine-gun armament, provision for fragmentation bombs and chemical containers.

The introduction of engines with two-speed superchargers will undoubtedly confer a greatly increased sphere of usefulness upon the attack machine. Possibly, with the engines receiving "full," or altitude, supercharge, the type may be employed as a fighter.

The Japanese army co-operation machine in the bottom right-hand view is hooking its message from what, to us, seems an extraordinarily great height by comparison with the "fishing" operations of our own Audaxes and Hectors at Hendon. It is not unusual for our "A.C." machines to pick up messages from a cord supported by two rifles with their fixed bayonets stuck in the ground. Incidentally, very few countries, other than Great Britain and Japan, equip their army aircraft with "fishing-hooks" as standard equipment.

"Doughboys" scurry away as a Northrop attack machine simulates the laying of a lethal trail during manœuvres. A defensive Boeing P.26A fighter is worrying the attacker, but must be at a great disadvantage over home ground.



Willow-plate fashion: a Japanese army co-operation machine plays postman. The height of the message-bearing cord is somewhat strange to our eyes. Judging from the eager attitudes of the ground personnel the picking-up of a message is a comparatively rare occurrence.

AN "M and S" PEGASUS

Features of the Bristol Pegasus XVIII with Two-speed Blower : New Cylinders, Finning and Valves

SEA-LEVEL performance of an "M," or medium-supercharged engine, combined with the high output at altitude offered by an "S" or fully supercharged unit, characterises an engine with a two-speed supercharger. Such a type is exemplified by the Mk.XVIII Bristol Pegasus, now in production at Filton. Complete details of the blower gear are not forthcoming, but numerous refinements have been incorporated to cope with the increased power over a wide altitude range.

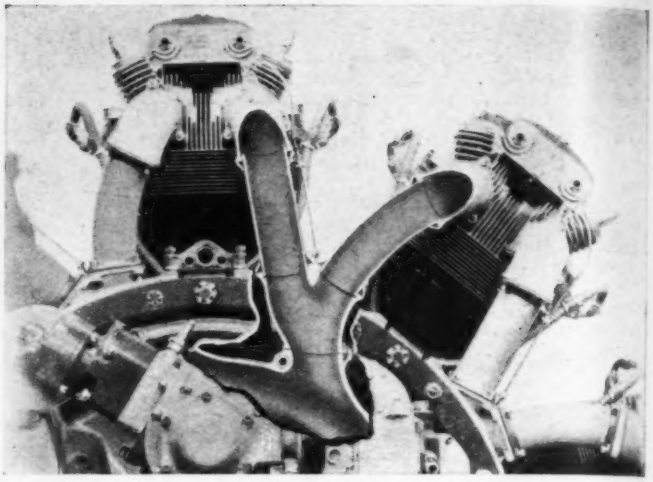
With the important exception of the two-speed supercharger, the advance in design of the new engine has been in the finer points, namely, the shape and size of induction pipes, increase in fin area, stiffening-up of valve stems, modification of airscrew shaft to take alternative v.p. airscrews, and redesigning of the rear cover to house the steadily increasing number of accessories and drives.

A state has been reached when little short of the magician's art is needed to increase the area of cooling fins on the cylinder, particularly the head. The new Pegasus, however, shows an increase in area of 164 per cent. for ten years of development. The figure is now 2,910 sq. in.—an area equal to a little over thirty *Flight* pages per cylinder! Recent increases in the fin area of the head have reduced the width of a single fin to less than 1/5th in. while the depth is in places as much as 2 in. Forging and machining is the only practicable method of producing such a complicated part.

Cylinder barrels, which are nitrided alloy steel forgings, have lately been improved greatly in strength and durability, and a running period of 3,000 hours is normal before regrinding is necessary.

Higher loads and speeds which must be borne by the valves have been met by increasing the stem diameter to give 30 per cent. greater cross-sectional area. Inlet valves, as well as exhaust valves, are now drilled hollow to reduce weight and the latter are, of course, sodium-cooled.

The whole Pegasus XVIII induction system has been redesigned, with fuel economy in mind, to take full advantage of the two-speed supercharge. A higher volumetric efficiency has resulted from the changes, which are chiefly an increase in the cross-sectional area of the induction passages and a more effective streamlining of contours to give an improved flow of induction mixture.



A sectioned view of the induction pipe assembly on the Pegasus XVIII. Points to note are the smoothly swept contours ensuring a natural flow of gas to each inlet valve.

BRISTOL PEGASUS XVIII.

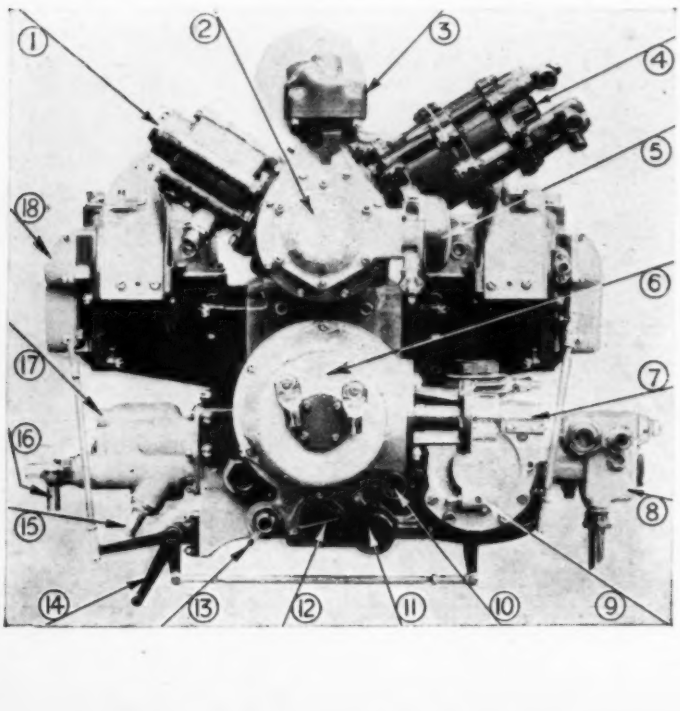
Nine-cylinder air-cooled radial, with two-speed supercharger and 0.5 : 1 or 0.572 : 1 reduction gear ratio. Rated on 87 octane fuel.

Bore	5¾in.	146 mm.
Stroke	7½in.	191 mm.
Capacity	1,753 cu. in.	28.7 litres.
	In "M" gear.	In "S" gear.
Take-off power	980 b.h.p. at 2,475 r.p.m.	——
International rating	820/855 b.h.p. at 2,250 r.p.m. at 5,000 ft.	765/800 b.h.p. at 2,250 r.p.m. at 15,500 ft.
Maximum power for all-out level flight (5 min.)	940 b.h.p. at 2,600 r.p.m. at 6,500 ft.	900 b.h.p. at 2,600 r.p.m. at 17,750 ft.
Overall diameter	55.32 in.	——
Length (to front cover of redn. gear case) from mounting plate	28.43 in.	——
From rear extremity	54.55 in.	——
Weight (bare and dry)	1,110 lb.	——

Improvements have been made to the supercharger entry and a new fully automatic Claudel-Hobson carburettor is fitted with automatic variable-datum servo units to control mixture strength and boost pressure. The volute casing is larger in area and the throttle bores have been increased in diameter.

The Pegasus XVIII is intended for use with the Rotol constant-speed airscrew, which is now in production and which is complete with its own special oil seal for transmitting pressure oil to the operating cylinder in the hub. The airscrew shaft has been increased from 90 to 100 mm. diameter to maintain the required safety limits, and a new bearing metal is used for the bevel pinion bushes.

A new airscrew shaft oil seal has been evolved.



The rear cover of the Pegasus XVIII, showing the following items : (1) High-pressure oil pump. (2) Spare accessory drive. (3) D.H. or Rotol constant-speed airscrew governor unit. (4) Low-pressure air compressor (R.A.E. type). (5) Drive for electric generator. (6) Combined electric and hand starter. (7) Starter handle connection. (8) Bristol dual fuel pump. (9) High-pressure air compressor (B.T.H. type A.V.A.). (10) Tachometer drive. (11) Oil feed inlet from tank. (12) Oil feed auxiliary filter. (13) Oil pressure gauge connection. (14) Interconnection between magnetos and carburettor. (15) By-pass to oil tank. (16) High initial oil pressure connection to crankcase. (17) Engine oil pump (18) B.T.H. double contact-breaker magnetos.

PRIVATE FLYING

FAMILY AMPHIBIAN: Used by several wealthy owners in the States as a family conveyance and as a means of travelling up to business in New York, the Grumman amphibian is a machine with a very definite place in the American market. With two Wasp Juniors the cruising speed (on 75 per cent power at 9,600 ft.) is 193 m.p.h. and the full-load ceiling on one engine is given as 14,000 ft. Not bad for an amphibian. There is now a seaplane "season" in the States and the Grumman makes the best of both elements.

Topics of the Day

Super-Ownership

WHEN they have their own exclusive aerodromes and their own little transmitting stations or radio beacons, private owners will be rather better able to make good use of their aeroplanes. I have said that before, but I'm still unable to see quite where the capital is coming from or how the ball can be started on its roll. Until aeroplanes are more useful private ownership will remain on its small sporting scale, and until there are more owners they cannot expect to see the facilities which would make these aeroplanes more useful.

Furthermore, this is quite a small island, and, to be any use at all, a standardised private traffic and radio system must be extended all over the Continent. And that is not very likely in the present state of international affairs. Only in France is there any number of owners within the full meaning of the word, but when all the nations have frightened themselves stiff with thousands more aeroplanes, bigger guns and bigger battleships, and the entire international farmyard has settled down quietly again, something may happen.

In the meantime it is interesting to find that the American owners of larger machines do, in fact, use radio quite a lot. Most of them have receiving sets to enable them to use the radio ranges, as the "four-spoke" beacons are called over there, and a few even use short-range telephony transmitting sets.

Across the Pond

OF course, something useful can be done in a country which is 2,500 miles from East to West and 1,500 miles from North to South, with one language and one government as far as flying is concerned. I cannot help feeling envious of the American private owners and surprised that there are so comparatively few of them.

Over here radio telephony is not a great deal of use even in this country, and practically valueless on the Continent. A receiver, used with a full understanding of radio beacon operation, broadcast station position and control rules in the vicinity of the different European airports, is about the only piece of radio equipment likely to be useful. In America, of course, W/T is almost unknown in the ordinary sense, and the transport pilots use radio beams in conjunction with telephony—which can be very useful and convenient for short-range air and ground control work. In fact, telephony is, ultimately, the only possible communication medium for amateur pilots, few of whom have either the time or the inclination to learn Morse and memorise the more important "Q" code items.

The general use of radio for us still boils down, therefore, to plain D/F reception, with either simple homing equipment, a genuine rotating loop or a radio compass. The latter is likely to remain beyond both the finances and the understanding of the amateur for some years to come.

If a few privately owned aerodromes could have short-range transmitters it might be worth the more expansive owners' time to fit and use a lightweight two-way telephony outfit—which might, in cases of emergency or on possible night flying trips, be used in conjunction with transport control centres. Needless to say, the transport services take first place, and these control centres are a good deal too busy in bad weather conditions to be bothered with the stray private owner, who might be left for an hour or more without attention while his fuel was running out.

The super-owner with a semi-commercial aeroplane and a trained crew is in the transport class and can use W/T both here and on the Continent to his heart's content. Nevertheless, even he must await the pleasure of the control officers when there are regular services also floating about in the gloom.

For Us Alone

WHETHER it would be possible for wave-bands to be designated and range-limits be imposed for private aerodromes can only be discovered when the demand is made. There is trouble enough over the channels in use by the transport people, and even Air Service Training is unable to do much about it owing to the proximity of the Portsmouth and Southampton radio stations.

In America there is at least one aerodrome which has been designed and is being operated strictly for the private owner. This is at Wilmington (Delaware, not Sussex), and, apart from the usual hangar, maintenance, lighting and similar services, a short-range radio transmitter and a radio range station are installed.

The lucky private owner of something very fully equipped can, therefore, be guided in on the beam and receive last-minute weather reports (with the barometric pressure for the purpose of resetting his sensitive altimeter) from the operator. The transmitter has three fre-

Private Flying

quencies and the range of the radio beacon is about fifty miles, but (according to our American contemporary, *The Sportsman Pilot*) the output can be boosted up immediately in cases of emergency.

Originally, of course, Heston was designed to be the private owner's Mecca, and the chain of aerodromes operated by the now defunct National Flying Services should have developed on everything-for-the-owner lines. Even now, in spite of the fact that it is Air Ministry controlled, that Jersey Airways use it, and that British Airways will shortly be at home there, Heston continues to be primarily an amateur's centre. Hanworth's position is only partially spoilt by Reserve School and manufacturers' operations, and the plan behind Mr. Whitney Straight's chain of aerodromes is very similar to that behind the old N.F.S.

Nevertheless, in the present state of things, the amateur-only scheme hardly seems to be an economic possibility. In order to make ends meet an aerodrome owner must necessarily do his best to encourage transport operators and manufacturers, or get himself a nice Reserve School contract. A compromise is the best that can be expected until there are more aircraft owners. One day, perhaps, we shall have our own aerodromes, our own radio beacons and our own little transmitting stations. Maybe.

INDICATOR.

FROM the CLUBS and SCHOOLS

EDINBURGH

OVER 100 hours' flying was carried out by the Edinburgh Club during October—a figure which represents a record in its history. One new "B" licence was obtained and five new members have been enrolled during the past week.

LONDON

The flying time for last week was 42 hr. 15 min. Mr. D. A. Hughes was enrolled as a member.

YORKSHIRE

Club machines flew 25 hr. 25min. last week and flights were made to and from Doncaster, Brough and Newmarket.

NORTHAMPTON

The average flying total was maintained during the week and included two cross-country trips to Hendon and Reading. The annual ball will be held at the Salon de Danse, Northampton, on Friday, January 28, 1938.

SOUTHEND

Flying during the week was well up to average, particularly on Sunday, and members are concentrating on blind flying. Mr. Wallace passed the Hendon test for general flying and cross-country. Several new members joined.

YAPTON

Heavy rainstorms were responsible for the low flying time of 18 hours last week. The Moth, recently away on C. of A., has now returned. Mr. Noel Larrington completed his "A" licence tests and Mr. R. W. Kirkwood has joined the Club.

BORDER

Adverse weather conditions practically curtailed all instruction flying during the week ended October 30. Cross-country flights, however, were attempted to Newmarket, York, Newcastle and Renfrew. Mr. A. Scott completed "A" licence tests, and Mr. Henderson passed his altitude test. The annual meeting was held in the Crown and Mitre Hotel on Tuesday, October 26, and was very well attended

PORTSMOUTH

F/O. H. Mitchell, R.A.F.O., has joined the Portsmouth Aero Club as chief instructor, whilst Flt. Lt. H. J. A. Williams has taken an appointment with the Royal Air Force at Digby, Lincs. Total flying for the week ended October 29 amounted to 10 hr. 40 min. Heavy winds and bad weather rather handicapped flying instruction. Lt. E. E. Mayo, R.A.N., and Messrs. J. F. Williams-Wynn and R. A. Powell qualified for their "A" licences.

MIDLAND

Cross-country flights were made to Sywell, Leamington, Walsall and Cardiff, and 21 hours were spent in the air. Messrs. A. Whitehouse and L. Davies were both successful "A" licence candidates.

C.A.S.C.

Last week-end members flew 10 hr. 35 min. at the new Cambridge aerodrome. Mr. J. G. Arrow made his first solo, and Mr. G. Laming completed his initiating flight for membership.

HANWORTH

Three "A" licences were secured at the London Air Park Flying Club by Messrs. Fitzimmons, Allen and Sherwood, all members of the Midland Bank Flying Club. The total flying for the week was logged at 47 hr. 35 min. Messrs. D. A. Willans and P. Hatrick joined as flying members.

MARSHALL'S

While the Puss Moth was flown to Newcastle, other cross-country flights were made to Hatfield, Norwich and Leicester. October 27 was a blank day as regards flying, owing to the unpleasant weather, and flying for the week amounted to 76 hr. 15 min. Mr. Hillman made his first solo.

NORFOLK AND NORWICH

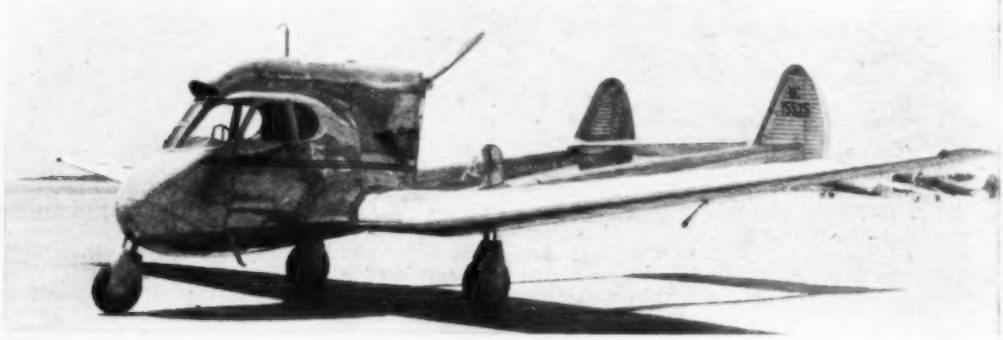
An anonymous gift towards the funds to help the younger pilots is acknowledged with many thanks. A new machine, a Gipsy Moth, has been added to the fleet, which is now five strong, and flying during the week was well up to average. The tickets for the annual ball to be held on Friday, November 12, are selling well.

CINQUE PORTS

More bad weather. Gales, high winds and rain caused a decrease in the flying times and the total dropped to 36 hours. A slight improvement was felt last Sunday. Mr. David Llewellyn flew to Reading to take delivery of Mr. T. C. Saunders' new Whitney Straight. This machine is to accompany Mr. Saunders back to South America and is a very up-to-date type fitted with Sperry equipment and long-range tanks.

BROOKLANDS

Five machines from the Portsmouth Aero Club visited Brooklands for lunch last Sunday and were duly made welcome. Brooklands Aero Club hope that other clubs will follow the example set by Portsmouth and pay them a visit en masse. Capt. Duncan Davis, with Messrs. Douglas Watson and Bishop, are very proud that they were the first visitors to Reading Flying Club in their new premises. Mr. McLeod completed his "A" licence tests, and the flying time for last week stands at 51 hr. 21 min.



ALL IN ONE: Three very modern features appear in the latest version of the Stearman-Hammond "Y" monoplane. A tricycle undercarriage for glide-in landings and ground manœuvrability; the pusher arrangement for comfort and forward view; and all-metal construction for ease of maintenance. With a Menasco C.4 (125 h.p.) engine the maximum speed is 120 m.p.h., the landing speed is 40 m.p.h., and the cruising range 550 miles. An example of the Stearman-Hammond is at present in Holland and it may shortly be seen in England. N. V. De Schelde, of Vlissingen, hold the European rights for this singularly interesting machine.

Instructional Return

THE Bombay Flying Club's instructional flight is now safely back in India. During their stay in this country and on the return flight the members of the party have put in 440 hours. While in England they bought two machines—a D.H. Tiger Moth and a Percival Gull—which were flown back in the ordinary course of events.

More clubs over here might consider the idea of a series of such flights in Europe during the summer. Air Service Training do quite a lot of it nowadays. The Bombay members find the trip a convenience, apart from the useful experience gained, because the weather conditions at home are not too satisfactory.

Southend's Party

PERHAPS to ensure good appetites, the Southend Flying Club's annual party started with the dancing at Garon's Hall and dinner (or supper) was not served until after ten o'clock. During this function general good fellowship was demonstrated by much drinking of wine one to another—some more important members being almost permanently on their feet.

Following the toast to the King, Councillor Alec White, deputy Mayor of Southend, proposed the health of the club. He praised them for continued good work and said that during the last year more "A" licences had been obtained, more cross-country flying done and more joy rides given than ever previously. The President of the Club, Mr. G. E. Weber, said in reply, that their objective of 1,000 hours' flying instruction for the year had been realised, and from October, 1936, to September this year the total was 1,154 hours, although one machine had been out of commission for some time during this period. Mrs. Hay replied to Mr. Seton Bowers' toast to the Ladies and Visitors.

More than once, speakers bemoaned the fact that the Southend Council gave no help to the club, although the Deputy Mayor was thanked for being present at one or two club affairs. It was hoped that they would be encouraged to make more effort.

Mr. A. W. Bevan and Mr. Harry Clarke, the Chairman and Vice-chairman respectively, spoke briefly and the party finally resumed dancing in the ballroom. The dance music was more in keeping with the atmosphere of previous Southend parties than the rather depressing sounds which were to be heard during dinner.

Reductions at Bristol

WITH the help of the new subsidy scheme and in order to make flying more popular in the Bristol area, the Bristol and Wessex Aeroplane Club has reduced "A" licence dual in the Cadet from 50s. to 42s. an hour—not including the pre-2 p.m. 10 per cent. reduction which was already in force and which will be continued.

Special concessions are given to members who wish to spend the night away and for Sunday morning "breakfast parties." Provided that the machine is taken away later than two hours before sunset and is returned again by 11 a.m. the rate is £1 an hour, this rate applying also to the breakfast patrols. Additionally, half an hour's dual or an hour's solo is given to every member who renews his or her licence—a scheme which is already normal at a great many clubs.

More important still, perhaps, is the new scholarship scheme which has been brought into action by the generosity of a member who wishes to remain anonymous and through the assistance of the *Bristol Evening Post*. The competition will remain open until November 6, and the scholarship winners will receive full "A" licence training for the cost merely of a trial lesson.

Mr. Govind P. Nair

AFTER covering less than 200 miles of the 10,000 which he had planned, Mr. G. P. Nair, the Hindu airman, crashed and lost his life at a point some 30 miles south-east of Dieppe. He had intended to fly to Dakar, across the South Atlantic, and back across the North Atlantic.

Those who knew him were quite certain that he had neither the experience nor the qualifications to succeed in such an ambitious project, and could only hope that the inevitable failure might not have involved his death. His plan to leave Marseilles aerodrome, which is neither very large nor very smooth, with full tanks and an overload of 1,000 lb. on a machine with which, as his take-off at Croydon last Thursday showed, he was not familiar, alone meant almost certain disaster. He was licensed and the machine was his own property, but it is a pity that nothing could have been done to discourage him from the attempt.

Still More Super-ownership

ONE Capt. George Whittell, a very wealthy American sportsman, has recently ordered a private machine on a size-scale which has not, we believe, previously been even considered. Over here Lord Beaverbrook did consider the purchase of a D.C.2 and Supermarines built something special in the flying-boat line a few years ago, but this private-owner type takes the prize.

It is to be a four-engined Boeing landplane similar to the series now being built for T.W.A. and P.A.A., and will have accommodation for thirteen passengers with more than the comforts of home. The range will be 3,300 miles and the maximum speed 250 m.p.h. The words "very wealthy" in the first line take on a special meaning when it is realised that this Boeing will have four 1,100 h.p. Cyclones to pull it along.

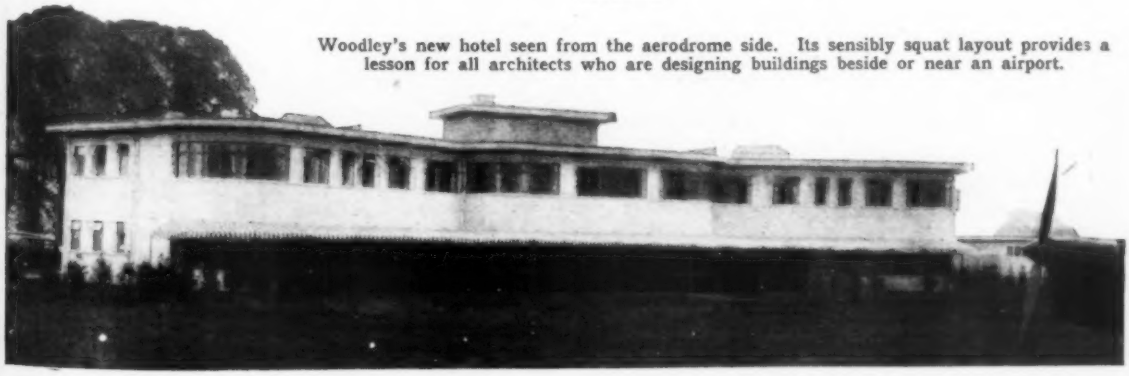
A pity, perhaps, that the newspapers have completely worn out the term "flying hotel," which they applied to all versions of the D.C.2 for a couple of years or so after the Australia race.

A New Falcon

WOODLEY has just got a new Falcon and this time it was not designed by Mr. Miles nor built by Phillips and Powis. The designers were Messrs. Guy Morgan and Partners, and the builders, Collier and Catley, of Reading. The fuel used is mainly the product of H. and G. Simonds, Ltd., of the Brewery, Reading, and the new craft is an extremely attractive hotel occupying a very small part of the Woodley aerodrome.

At the opening luncheon of the Falcon Hotel last Friday, speeches were made by Mr. F. A. Simonds, managing director of H. and G. Simonds, Lord Herbert Scott, Mr. A. F. Sidgreaves, chairman and managing director respectively, of Rolls-Royce, Ltd., Mr. F. G. Miles and Mr. Reginald Palmer. The hotel represents something of a triumph of mind over matter in that in spite of relatively modest dimensions imposed by the fact that it is situated on the aerodrome, the rooms give an impression of spaciousness. The centre block of the hotel measures 59ft. by 36ft., and the two wings each measure 40ft. by 30ft.

On the ground floor one wing houses a large dining room, above which is an extremely attractive club lounge facing the aerodrome. The centre block contains the public lounge and bar. In the other wing is the club bar and the offices of the management. The interior decorations are by the brothers Morton, and are both appropriate and attractive, up to date without that brutal touch which so often mars otherwise sensible modern products. A large proportion of the upper floor is occupied by the bedrooms, so arranged that all the double bedrooms give a view of the aerodrome while the single ones face the front of the building. The management of the Falcon Hotel is in the capable hands of Capt. and Mrs. Growdon.



Woodley's new hotel seen from the aerodrome side. Its sensibly squat layout provides a lesson for all architects who are designing buildings beside or near an airport.

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

VENTRE À TERRE : A Douglas DC3 with a temperamental undercarriage after being set down at Newark Airport at the expense of bent airscrews. The wheels of the Douglas normally protrude partly below the nacelles when the undercarriage is raised.

FIRE recently destroyed the hangar of Winnipeg Flying Club, and one aeroplane, at Stevenson Field. Damage was estimated at $13,000.

The Morane concern is erecting the first eleven of the MS 405 single-seater fighters (Hispano "cannon" engine) of a large batch ordered by the French Air Ministry. An improved fighter, designated the MS 420, is estimated to be capable of 320-odd m.p.h.

The German Arado company has built an outstandingly versatile twin-float seaplane which is described as a semi-cantilever biplane. It is stressed for catapulting, has folding wings, can carry bombs, a torpedo, or smoke-screen apparatus and is capable of 196 m.p.h., presumably when carrying reconnaissance load.

Twenty-eight Pratt and Whitney Twin Wasp engines of the 1830-C series, designed for operation on 100-octane fuel, have been ordered by the American concern, United Airlines, for installation in new Douglas DC-3 "Mainliners." The maximum output of these units, which will give higher commercial cruising speeds, is 1,200 h.p.

The International Union of Aviation Insurers has formed a joint standing committee with the International Air Traffic Association, to deal, it is stated, with matters of mutual interest. At a meeting of the International Union in Rome last month, Capt. A. G. Lamplugh, of the British Aviation Insurance Company, was re-elected chairman.

Twenty-five Years Ago

(From "Flight," November 9, 1912.)

"Owing to the bad weather which prevailed on Tuesday last, Guy Fawkes' Day, it was decided to postpone the programme of night flying and 'war in the air' until this (Saturday) evening, when visitors to the London Aerodrome, Hendon, should, weather permitting, be served with a 'bumper' entertainment. A mimic fortress has been built, and after being bombarded from the aeroplanes with fireballs it will end in a huge bonfire. The grounds will be illuminated, and the aeroplanes will carry searchlights, etc."

A large area of Brighton was "blacked out" early one morning last week to test the air raid precautionary measures lately instituted in the town. Three machines from Kenley co-operated and a section of a road was treated with a chemical which gave off fumes resembling those of mustard gas. Hits by bombs were represented by fireworks and flares.

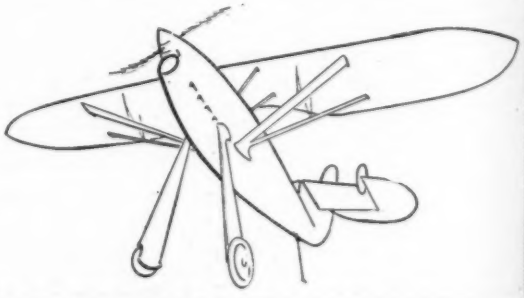
The Heinkel He.112 single-seater fighter described in *Flight* last week has been demonstrated before Swiss military authorities. Heinkels have installed an inverted-vee Mercedes in an He.70 single-engined transport with a marked gain in performance.

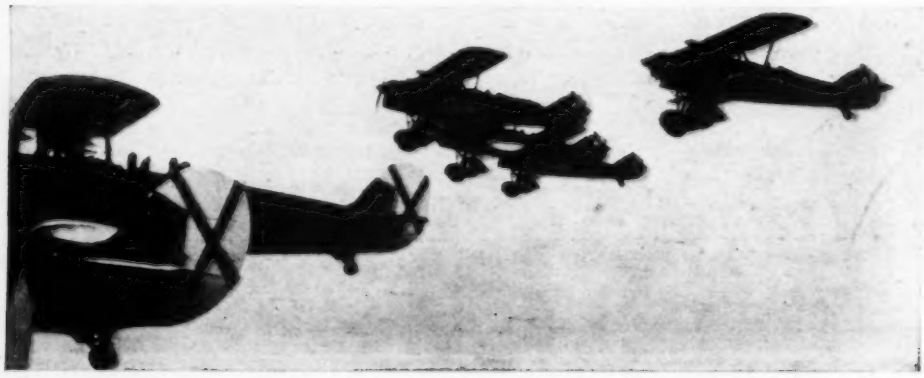
THE UNKIND UNTRUTH

(with apologies in all directions)

No. 8

The F W. Stilz





ESCORT : A flight of Fiat CR32 single-seater fighters conducts Romeo reconnaissance machines (nearer the camera) into Spanish Government territory. Note the cross adopted as the standard Insurgent marking.

SHADOW FACTORIES in BEING

The Five Works at Coventry and Birmingham Visited and Described in Detail : Remarkable Progress in a Short Space of Time

Left to right : Lt.-Col. H. A. P. Disney of the Air Ministry, with key men of the Rootes factory : Mr. W. E. Rootes, Mr. A. A. Rowse and Col. J. A. Cole. (*Flight* photograph.)

IT was in June, 1936, that the Government's "shadow factory" scheme was announced. In the short space of time intervening the work of planning and building five large aircraft factories in the Midlands has been successfully completed and production commenced. The contractors had an unusually difficult task in four of the five cases, only one site being dry and level. Even so, the Air Ministry were called upon to pay out bonuses promised for work completed ahead of schedule.

Earl Baldwin, then Prime Minister, revealed the two-fold plan adopted by the Government to hasten armament production following a review of civil industry by the Committee of Imperial Defence, and work commenced shortly afterwards with energy.

The object of the scheme as applied to these Midland car manufacturing firms at Birmingham and Coventry is to provide some of the aircraft and engines required under the Royal Air Force expansion plans and to give experience to the selected firms in this type of specialised work in order to provide a large reserve of productive power in case of a national emergency.

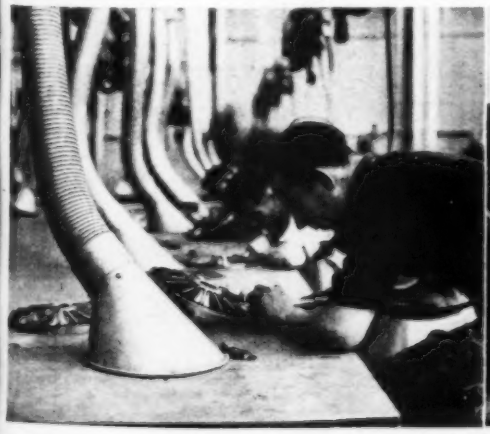
Five manufacturers undertook to manage the Government factories, and on technical, economic and administrative grounds sites were chosen near to the "parent" factories. At Coventry, Rootes Securities, Ltd., the Standard Motor Company, Ltd., and the Daimler Company are participating in the scheme, while in the Birmingham area are the Austin Motor Co., Ltd., and the Rover Co., Ltd.

The aim throughout the organisation has been to simplify, so far as possible, the production of the aircraft and engines, and although doubts were expressed in certain quarters as to the practicability of the scheme, in particular the marrying-up of separate units, it was decided to produce certain engine components by specialisation methods at each factory, rather than turn out complete engines from each. By this means considerable economy in jigs, tools and gauges has been effected.

The engine chosen for production is the Bristol Mercury VIII, a fully supercharged nine-cylinder air-cooled radial with a power output of 825 h.p. at 13,000ft. Two of these engines—which are the design of Mr. A. H. R. Fedden—are installed in the Bristol Blenheim medium bomber, now being produced in quantity for the R.A.F.

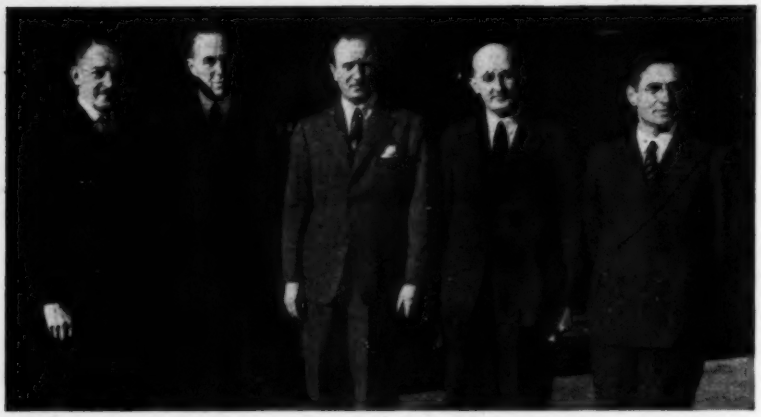
All technical supervision has been in the hands of the Bristol Aeroplane Company which, on the introduction of the shadow factories scheme, formed a special department to deal with the work. The machine-tool and other equipment of the new factories is at the moment based upon that of the Bristol Company, as are the method and sequence of operations and estimated rate of production. If, however, firms managing the shadow factories are able to improve production methods by reason of the first-class equipment at their disposal, every encouragement and help will be given to them to do so. The work is paid for by the Air Ministry at an agreed rate.

To have designed, built and equipped in twelve months five factories with new machine tools embodying the latest practice, and this during a period of increased demand



A polishing operation on a supercharger impeller at the Humber factory. Metal dust is extracted through the flexible trunk.

Inspectors at work in one of the air-conditioned, discharge-lighted, constant-temperature, vibration-proofed standards rooms which are a feature of each of the shadow factories. (*Flight* photographs.)



At the Standard works : (left to right) Capt. W. A. W. Hallam, assistant director of Aeronautical Production ; Mr. O. Clegg, technical adviser to the same department ; Capt. J. P. Black, managing director of the Standard Motor Company ; Mr. Cole, works manager ; and Lt.-Col. H. A. P. Disney, director of Aeronautical Production. (*Flight* photograph)

from other industries, is a feat bordering upon the miraculous. The shops themselves are of the most modern design, air-conditioned, and having high roofs and a minimum of overhead cables and roof members. Wide concrete gangways separate the lines of machines, each of which has its separate power supply. These conditions combine to give exceptionally light, airy shops and pleasant working conditions.

A very large percentage of machines are British ; certain of them, designed for special operations, were unobtainable in this country until recently, when they were produced specially for the shadow factories.

A study of the selection and training of hands would in itself provide a separate article, for a large percentage of the men were recruited from unemployed in special areas : in particular from the lace and cotton trades. It has been found that after a short training period these men have become very efficient in their specialised jobs.

The percentage of skilled labour is lower in the shadow factories than at the Bristol works, and processes which have previously been skilled jobs are now carried out by semi-skilled hands. The shortage of skilled men had been anticipated, and suitable jigs, gauges and tools were devised to simplify the operations. The quality of the products has in no way suffered by this change. The first sets of "shadow" components have been passed by the Aeronautical Inspection Directorate and successfully assembled, and the first complete engine is now at Bristol undergoing acceptance tests.

The location of the Government factories beside the respective car works will not interfere in any way with the firms' normal productions ; indeed, the additional number of trained hands will provide the firms with a reserve of labour. Peace-time production provides for a single shift per day, and it is hoped to reach full production on this basis early next year.

Before dealing with the products and work of the individual firms a tribute should be paid to the excellent understanding and spirit of co-operation between the managerial section of the car firms and the special technical department of Bristol's, which has been so largely responsible for the inside organisation. This co-operation has been instrumental in producing the successful results in the short time which has elapsed since the scheme was announced.

Smartly clad operatives at the Daimler works engaged in assembling finished halves of the Mercury crankcase. The cylinder studs all have ground threads. (*Flight* photograph)

Although the factories differ in shape, size and arrangement several departments are practically standardised—in particular, the section known as the standards' room, in which jigs and tools are checked regularly for accuracy. In each case this room is divided from the rest of the shop by separate walls which are vibrationless and practically sound-proof, and there is a separate concrete roof. The air is conditioned and a constant temperature of 68 deg. F. maintained. Lighting is by strip discharge tubes arranged across the ceiling in groups of three ; these, by special colour blending, give brilliance of illumination without glare, a minimum of shadow and no heating effect.

The instruments in these departments are of the most modern types and include a tool-makers' microscope, an optical dividing head, thread gauges, etc. Accuracy to one ten-thousandth of an inch is expected of all vital working parts of the engines.

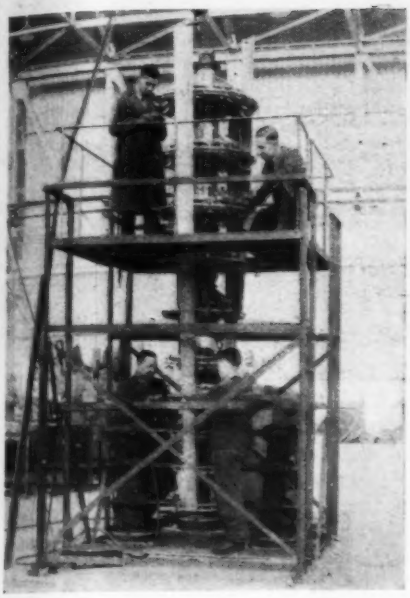
Inspection departments for raw materials are also similar in the factories ; magnetic crack-testing apparatus and the more usual impact hardness and tensile machines are to be seen. It is particularly noticeable throughout each of the works that many kinds of delicate inspection machines are in use.

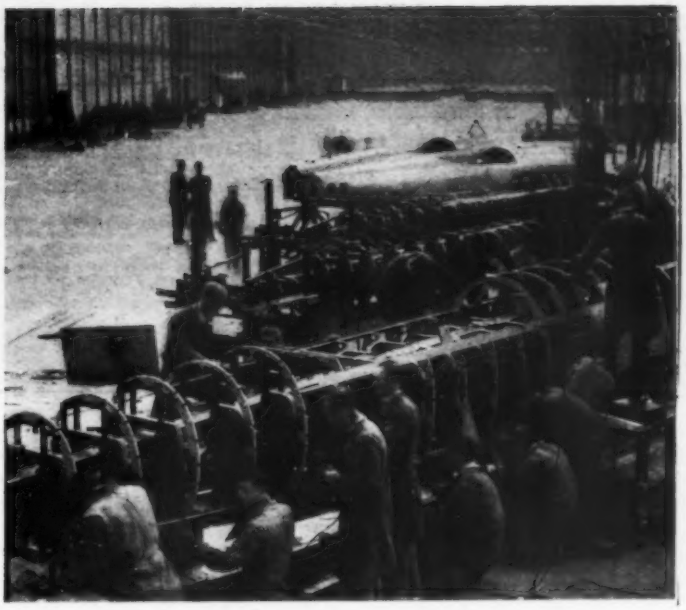
Planning for Convenience

The heat treatment sections naturally vary according to the work of the factory, but a neat, roomy layout is characteristic of all, while the position in the works proper is planned to be as convenient as possible for intermediate treatment during machining or plating. Each plating department has acid-proof red tile floors, and the lower half of the wall facing is of the same material. Enamelling is also carried out in this section, next to the plating vats, which are chiefly for tin, chromating, and cadmium.

A point of considerable importance in the factories is that all machine tools are issued correct and ready for use from a central stores, and there are no grindstones about the works for the use of individual machine operators.

On arrival at Coventry the first factory visited was that of Rootes Securities, Ltd. (Humbers). This firm is responsible for producing most of the engine units abaft the crankcase. These consist of the supercharger and its drives, the oil pump, and the auxiliary drives for the oil





(Left) With a view to saving space and adding to accessibility a vertical rig has been developed by the Austin Company for the construction of the rear section of Fairey Battle fuselages. (On the right) Whole Battle fuselages are beginning to take shape in the vast erecting section of the Austin factory. New Austin cars are temporarily stored at one end. (*Flight* photographs.)

and petrol pumps, magnetos, two compressors, generators, and tachometer. Also included are crankcase rear covers carrying these drives, induction elbow pipes, and inter controls between carburettors and magnetos.

In the main shops, which cover about 2½ acres, one sees complete lines of machines with operators. About 90 per cent. of the machines have been delivered, and, judging from appearances, only a few more hands will be needed for the factory to reach full production early next year.

Owing to the variety of parts manufactured, certain departments have unusual prominence, and a very careful planning has been necessary. The heat treatment shop contains both gas and electric furnaces to deal with high-tensile steel and also with aluminium alloy. Carburising pots are mechanically fed into the furnaces.

Several plating processes occur, and a number of parts —supercharger casings inside and outside and impellers— need to be highly polished. For convenience the two departments concerned and the heat treatment section needed to be in close proximity to the machine lines.

Of the rear cover a number of parts have to be enamelled before assembly. For this purpose sprays and a continuous stoving oven have been installed. The assembly of the supercharger takes place on benches covered with zinc and rubber to prevent damage to the parts.

The first set of components from this factory was completed on October 4, 1937.

Our second visit was to the factory of the Daimler Co., Ltd., which was commenced in September, 1936. It is interesting to note that the site is part of the old war-time Coventry aerodrome.

One very large and light shop, covering about three acres, has been built. Wide spacing of machines and the size of the building give an impression that it is less advanced than some of the other factories. Actually, over 80 per cent. of the machine tools have been delivered, and the factory is very little behind Rootes and Standard.

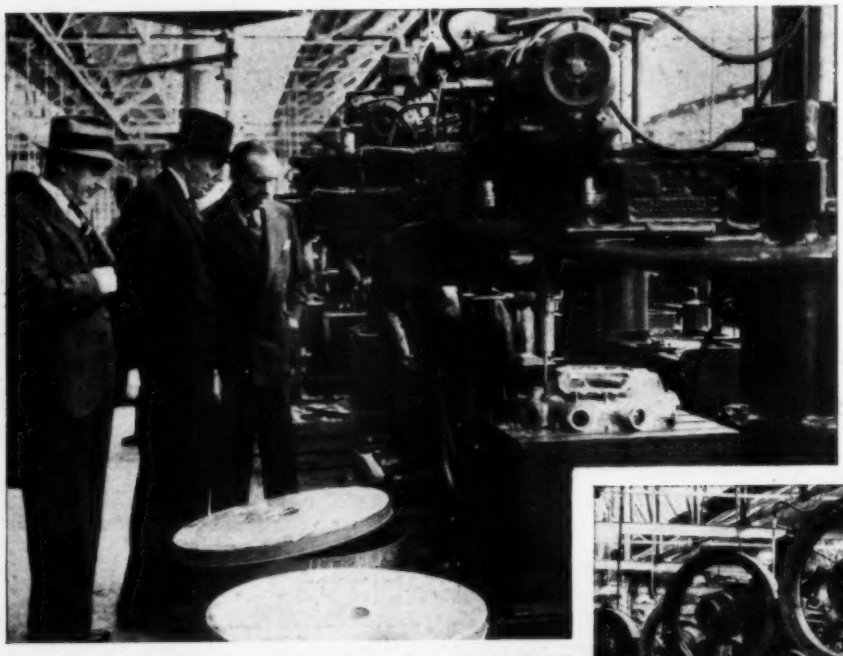
The first full set of components were completed on September 25, 1937. These are the two halves of the crank-

(*Concluded on page 449. A display of shadow factory pictures appears overleaf.*)

Chiefs of the Rover factory: (left to right), Major B. H. Thomas, works manager, Mr. S. B. Wilkes, managing director of the Rover Company, and Capt. G. H. Savage, works director.

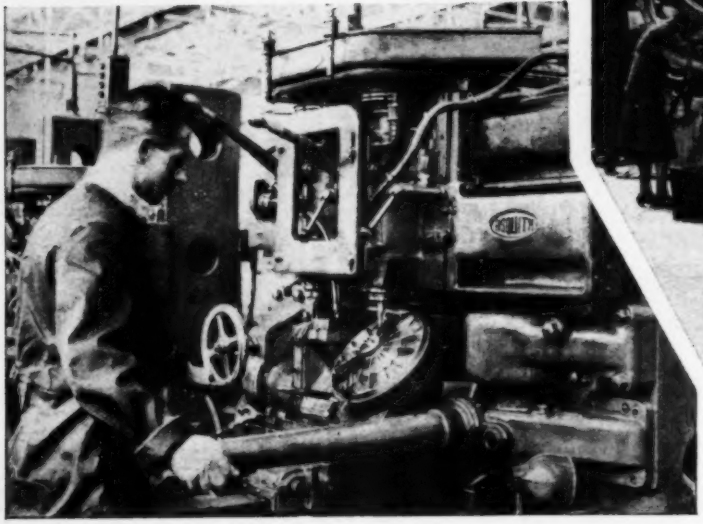
(Left to right) Mr. C. R. F. Englebach, works director of the Austin Company, Mr. G. Ledgard, works manager, and Lord Austin, chairman, who are responsible for the Austin share in the shadow scheme. (*Flight* photographs).

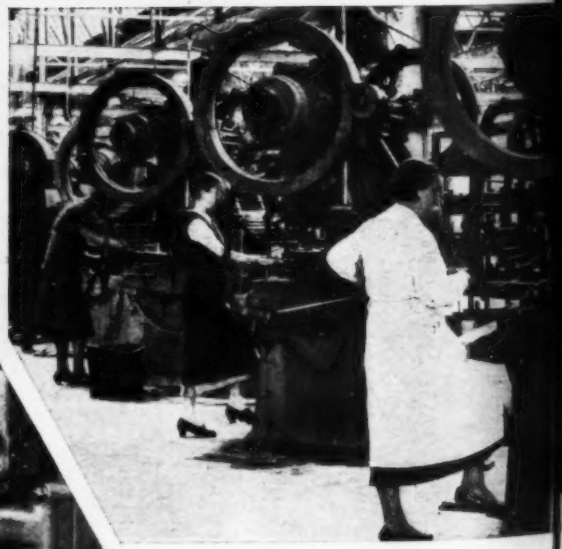
ON the GRAND SCALE: *Some Further Impressive Views of the Shadow Factories*



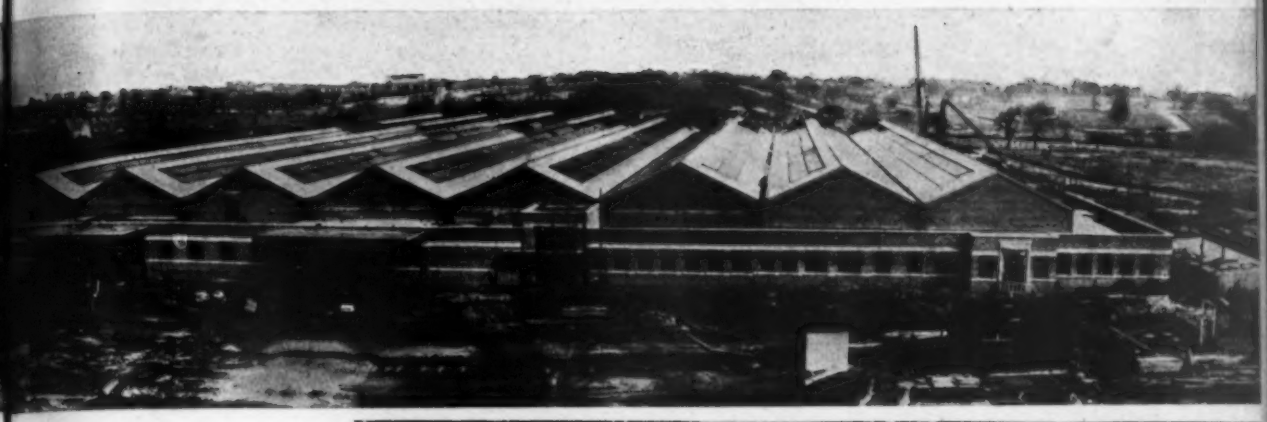
(Top left and right). The site of the Rover factory near Birmingham in October, 1936, and, by contrast, the almost completed buildings in May, 1937. These two photographs give an idea of the difficulties confronting the builders and also afford an example of the speed with which "Shadow" building was carried out.

(Left). Mr. W. E. Rootes and Air Ministry officials watch a drilling operation on a volute casing. (Bottom left). A machine of a type which had previously to be obtained from America has been supplied to the Rootes factory by a British firm. The operation is high-speed profile milling of a high-tensile-steel supercharger impeller.





(Above) Girl hands attend the smaller presses in the aircraft department at Austins, Birmingham. Safety guards, which must by law be fitted to such machines, can be seen in the photograph.



(Right) A battery of Hey machines at the Standard works are seen profiling a lower cylinder barrel flange. To avoid distortion during grinding operations on the same machines the barrels can be held by mandrels carrying rubber strips which expand outwards to grip the bore. While on the conveyor rollers metal shields, designed by the Standard Company, are fitted to protect the head cooling fins.

(Below) Machining one half of the Mercury's split crankcase at the Daimler works. One face of this casing must match up to the supercharger unit from the Humber factory.

(Right) Accuracy in drilling and reaming the holes in the master connecting rod is assured by using a jig. The holes will later take the bearing pins for the auxilliary rods. A partly machined master rod, the work of the Rover factory, is also resting on the machine.

AIRCRAFT v BATTLESHIPS

Blackburn Baffin torpedo bombers (Bristol Pegasus) of the Fleet Air Arm approach *Courageous* from behind a smoke screen laid by H.M.S. *Crusader*, the attendant destroyer. "Naviator" has his own ideas about torpedo bombers.

Which Holds the Whip Hand? A Controversial Examination. By "NAVIATOR"

AN immense amount of balderdash has been written on this subject by fanatics on both sides. The characteristic of the fanatic is not so much that he cannot consider the other fellow's point of view, but that he does not want to do so. He is not sincerely searching for truth; he is merely defending a prejudice obstinately.

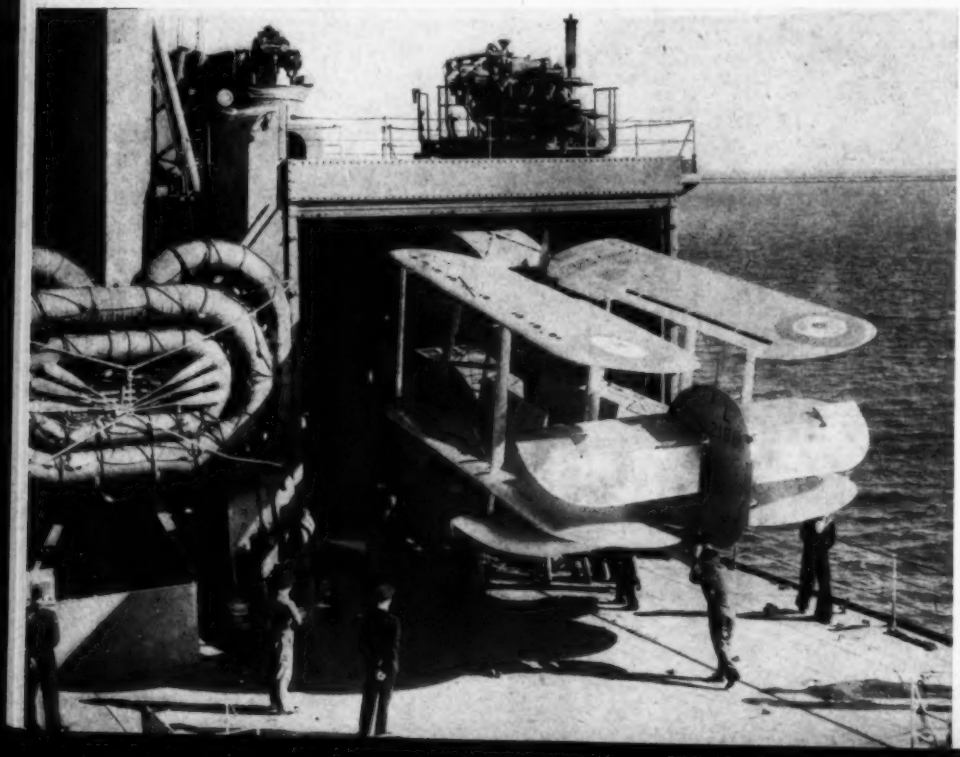
Many years ago an old American battleship was moored (in case she might swing in an inconvenient direction!) off shore. After many weeks of complicated preparation a great fleet of aircraft, laden up to the possible take-off limit with bombs of every conceivable size and shape, came staggering out from the nearby shore to prove for posterity what aeroplanes could do against battleships.

Flying slowly and carefully up-wind over the hulk at low altitude, one of the machines eventually managed to explode an enormous bomb in the sea near her side. It was afterwards judged that this bomb was responsible for the vessel's sinking.

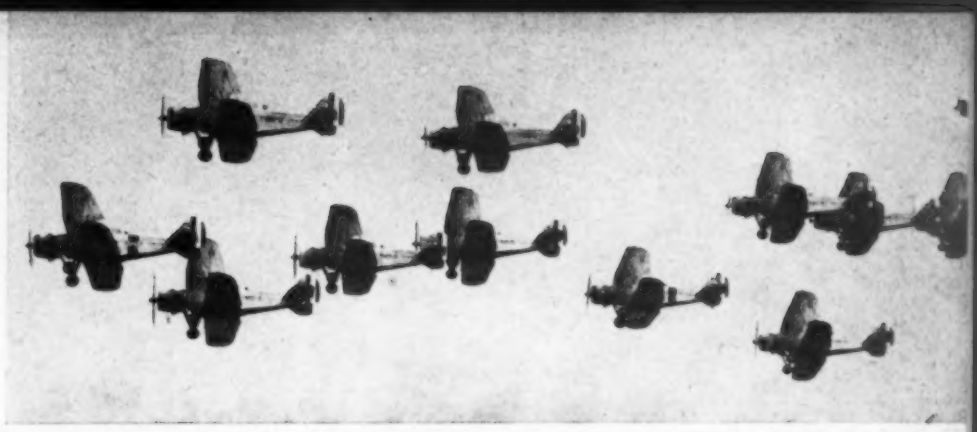
This classic effort has been quoted ever since and times without number to prove that a battleship can (and will) be sunk by aircraft. Actually, since the conditions did not in any way even remotely resemble those of real warfare, it did not prove anything of the sort.

If they had had an Autogiro, and large enough, they might have "proved" their point by lowering a delayed-action bomb down the funnel on the end of a wire hawser.

In any case, modern battleships are protected to a large extent against under-water explosions by "bulges" or "blisters" fitted along and below the waterline, and it is extremely unlikely that a single explosion of torpedo, mine, or bomb will cause the vessel to sink. At Jutland, *Marlborough* (without bulges) was torpedoed, but managed to continue with the fleet at 17 knots after shipping 1,000 tons of water. The Spanish insurgent battleship *España* (eight 12in. guns) was sunk by a



A Supermarine Walrus amphibian — one of two such machines carried on H.M.S. *Sheffield*—being tucked away in one of the special hangars. The mass of mechanism on the roof is a multiple pom-pom.



Great Lakes dive bombers (P. and W. Twin Wasp Junior) of the U.S. Marine Corps. These machines are believed to be capable of making diving attacks with a 1,000-lb. projectile.

single bomb dropped alongside her 8in. armoured belt by a Government aircraft. She sank within 45 minutes, taking with her about 500 of her crew. The German battleship *Deutschland* suffered damage from another air attack, but, fortunately for her, the bomb exploded on her deck and not in the water alongside, or she might have become at least a temporary casualty.

Our Government sub-committee appointed to report * on this subject gave it as their opinion that a capital ship was immune from fatal air attack, and other authorities interested in so doing have done their best to explain away such damage, with more or less success, depending on the ignorance and receptivity of an uninstructed public.

But what are the real factors which would determine the success or otherwise of aerial attack on fighting ships? Let us examine them in detail.

Pros and Cons

Naval officers (the writer was one himself) love to visualise a hostile air formation, say half a dozen foolish bombers, plainly visible many miles away, approaching on a steady course, at a steady speed, and at a steady, known height. They picture them harassed (if not immediately shot down like rabbits) by the fleet fighters while the guns of the entire fleet blaze away at them in the far distance, the lighter-calibre A.A. guns joining in the joyful chorus as the big guns, owing to their limited angle of elevation, one by one drop out of the game.

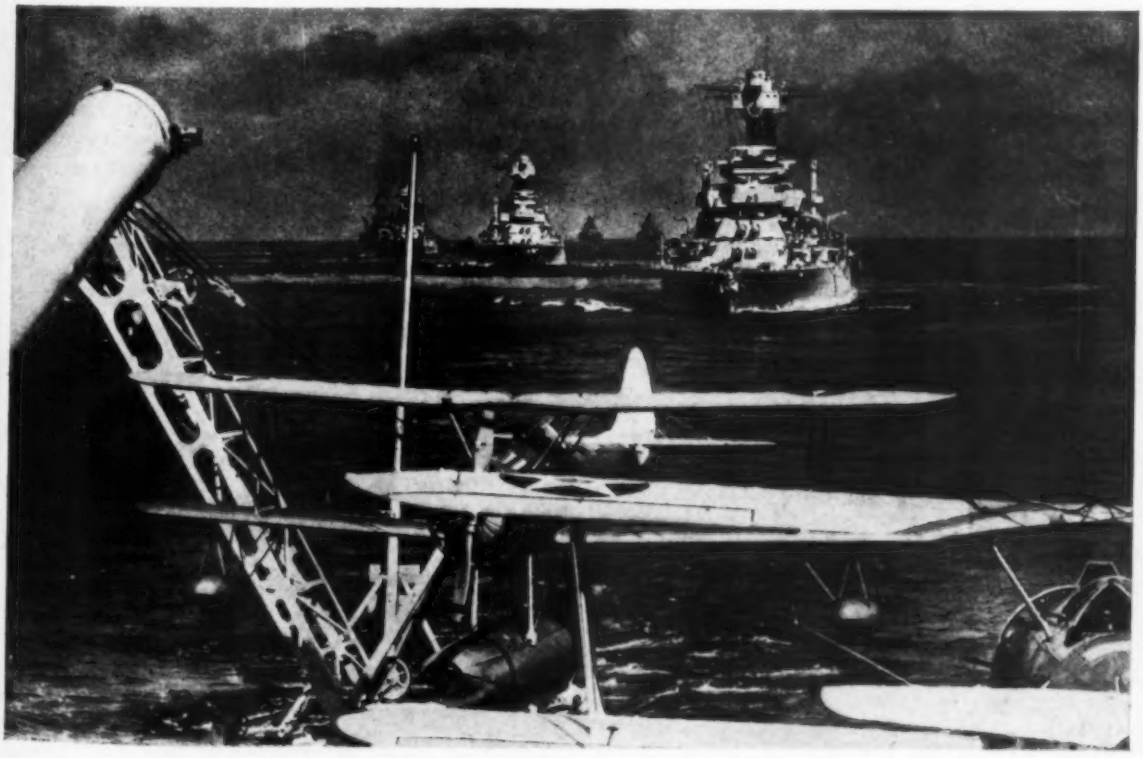
In real life this sort of thing, of course, would not happen. One of the elementary principles of war is for the attacker to choose the conditions for attack most favourable for himself and unfavourable for his opponent.

In the first place, the enemy would take good care not to be seen approaching. Next to speed and having three dimensions to manœuvre in, surprise is the aircraft's greatest asset and the one most easy to realise. The writer has been out flying with the express object of locating hostile aircraft, yet the first indication that he was not the sole occupant of the ether was the sight of tracer bullets streaming past him from behind. Very many war pilots have had this experience. Every war pilot knows that it is true. And, curiously enough, the larger the squadron the more easily can it be surprised; human nature being what it is, each man in a formation is subconsciously relying largely on the others to spot the enemy.

The bombing machines, say four or five squadrons of nine machines each, or perhaps very many more, would approach above, through, or in the lower edge of low clouds, or in rain or twilight, or with the sun behind them.

If absolutely forced to attack without cover of any sort the modern high-speed, high-ceiling day bomber would, as soon as he came within possible sighting distance from

* Command 5301. H.M. Stationery Office, Kingsway, 3d.



Vought Corsair single-float reconnaissance machines (which may also be used as light bombers) on the stern of U.S.S. *California*, flagship of the U.S. Battle Force, other units of which are seen astern.

A Hawker Osprey fleet fighter reconnaissance machine (R.-R. Kestrel) making a mock attack during Navy week on the cruiser *Coventry*, one of our special anti-aircraft vessels.

the fleet, make his preliminary approach by a swift, flattish dive in a curve or spiral from a great height and would be in position for the attack-dive within, say, 45 seconds. If this preliminary approach were rectilineal, one zigzag could be introduced, the length of the legs having been calculated in advance according to the time of flight of the ship's projectiles.

The bombers would arrive at their position for attack about the same time as, or before, the signal (if any) from outlying cruisers reporting their approach. It is unlikely they would be seen by the fleet until just about to enter the final dive, if then.

They would dive, perhaps, in half a dozen spiral streams, widely deployed, straightening out for a few seconds just before dropping their eggs from an altitude depending on the degree of surprise and the quantity and quality of the A.A. artillery, at a higher angular velocity than the heavy gun's training gear could comfortably cope with or the sights (at a complete loss as to deflection) cover with any sort of accuracy.

Defensive Patrols

It is unlikely that they would be located or caught by the fleet fighters unless the latter happened to be in the air (a fighter's fuel-hours are very limited) at or above that altitude, in that particular direction, freshly up from refuelling, and just at that particular time: An extremely improbable combination of possibilities.

There are various serious objections to the "permanently aloft" defensive patrol. In order to stand any chance of success in the few minutes at their disposal the patrol would obviously have to be the bombers' superior in numbers and performance; and to maintain this force in the air continuously would necessitate the possession of at least one more equally powerful reserve fleet on the carriers ready to relieve the first when its time was up for refuelling and rest, with a corresponding double-sized "ground" staff. Not a practical policy.

Also, a defensive state of mind is very bad for morale and confers all the advantages of the initiative on the enemy, which is good for his morale.

By night it is futile to put any reliance whatever on defensive aircraft. Their "visibility" is almost nil, and they would, as likely as not, be merely a hindrance to the ship's gunners and searchlight crews.

If the fighters did happen to find and attack the bombers they would be met with an exceedingly hot reception from the massed movable guns of the two-seaters. A weak point in the average single-seater fighter is that its guns are fixed to fire straight ahead and cannot be concentrated at close range (air fighting effective range is about 75ft.) without danger of collision with other machines. Also it is well known that aircraft may be riddled with machine-gun bullets and yet fly safely home.

If the bombers were in sight from below they would not, of course, fly at a steady height or on a steady course, but along zigzags and curves. Range and deflection setting of gun sights would be sheer guesswork, and exceedingly quick and agile guesswork at that. Even then, by the time the projectile had climbed the height and travelled the distance, the aircraft would have moved along various unpredictable courses far away from the point anticipated and aimed at by the gunners. Incidentally, shell time-fuses (other than clockwork ones) cannot be relied upon to explode at the time set for when traversing high altitudes in rarefied air. Many do not explode at all.

It would be perfectly easy for the attackers to close in and dive upon the ships from all points of the compass at once on, of course, a properly organised and prearranged tactical plan. The A.A. gunnery, under such circumstances, and rendered even more difficult by the rolling, pitching, and turning of its moving platforms, would inevitably find itself in a hopeless muddle, many or most of the aircraft not being fired at at all, much less hit. Each gun's crew would just have to go to it and snap at any plane which happened to catch their attention for a few seconds until another entered the field of view to distract their attention. The gunlayer at the elevation wheel of the older guns (nearly all our battleships are more than twenty years old) would never know which aeroplane his mate the trainer at the deflection wheel was aiming at, and *vice versa*.

The barrage, so effective on land, would not seriously disconcert an intelligent formation leader with a third dimension in which to manœuvre and the ability to attack from any or every direction. The layman's conception of an A.A. barrage is a solid wall of projectiles through which the unfortunate aviator has to fly before he can release his bombs. Actually, it is very far short of such a wall, even in theory.

A Fleet's Vulnerability

It is the aggregate of all these incidentals and accidentals that the air formation leader relies upon to help him get away with it.

For some time after a reasonably successful air attack, a fleet, though unlikely to have received any vital injury, would be in no fit condition to engage an equal enemy fleet—the work it was built for. And no fleet in future will be safe from night or low-cloud air attack while lying at an anchorage (an attractive target for torpedo attack), much less while in dock. There will be nowhere to nurse a sore head, much less lay up a broken one.

Bombers attacking from several directions in synchronised combination with submarines will constitute a menace to shake the stoutest heart, since no gunner can shoot in several directions at once. Some officers place great faith in aircraft carriers. This type of ship always conjures up in the writer's mind a vision of a basket of eggs—a basket that would be the first to be disabled in or before an action, at least as far as her flying deck was concerned.

The writer himself would like the command of a squadron of, say, fifteen or twenty (more if obtainable) very fast torpedo 'planes—clean-lined, twin-engined monoplanes with not an excrescence anywhere on their smooth-polished bodies, and a narrow sea to operate over. Air scouts would keep us informed of the position, formation, course, and speed of the enemy fleet, though we might lose them now and again temporarily on a moonless night or in heavy rain. We would attack by moonlight or twilight, or in the dark with parachute flares, or dive on them like hawks out of low clouds, surprise and speed our ever-faithful allies.

Even if the fleet fighters happened to be out, cruising in our direction, and chanced to catch a glimpse of us among the clouds, and could catch up with us, they could not

stop the great majority of us; our guns would be as good as theirs and concentrated *en masse*. Not until our fighters have *canons* will they have any real advantage over the bomber (even if the latter also have large-calibre weapons), that is, of course, assuming they can find and catch up with them.

By the time the fleet gunners had discovered and got their sights on to some of us we would be falling at an enormous velocity in one or many long strings, or spread out fanwise, or diving from all directions, according to plan—some of these feint attacks, perhaps, to distract attention.

We should flatten out low down between the battleships and their anti-submarine screen of cruisers and destroyers, and to fire on us then, or to put up a splash barrage, would be to risk hitting their own ships beyond us. With our machines 15ft. above the water, covering a mile in fifteen seconds, it would take the gunlayers all their time, and then some, to follow us with handwheels or hydraulics. There'd be no time to calculate, transmit, or set range elevation or deflection on sights (all essential if hits are to be hoped for), much less set the time fuses for the shells.

A high-velocity 5 in. firing cannister (bags of bullets) would be the most effective weapon at fairly short ranges, being able to sweep a very large area and deliver as many bullets per minute as several batteries of machine guns. This would force divers to release their bombs from a higher altitude, say, 7,000 ft., if attacking in broad daylight and without surprise. However, not a single one of the gunners would ever before have fired a shot at hostile aircraft or under conditions approximating in the very slightest degree to real war conditions.

We might fly down the line for a few seconds, ten on either side, from opposite directions, or all in line, depending on light, the disposition of the ships and on various other considerations. Turning steeply, we would drop our "mouldies" at a range at which a miss could scarcely occur.

Even after an attack in which everything had gone against the aircraft, many having been shot down, and in which only four or five of the capital ships had stopped a torpedo or two, that fleet would be in no fit condition for a fleet action for a considerable time to come.

A small force, such as four or five scouting battle-cruisers, each costing as much as forty of my aircraft and carrying thousands of men on board, would stand a very good chance of being annihilated if attacked, each by four or five torpedoplanes simultaneously.

In a desperate struggle for national existence the easiest, most effective and most humane weapon would be the spraying of ships downwind with liquid mustard gas, against which masks are futile, though this gas is not lethal. The gas would be sucked down by the ventilating fans and so delivered to every remote corner of the ships, its blistering effect incapacitating the entire crew for several weeks.

Actually, no man can certainly foresee this future, but nevertheless the aviator who thinks he can carry on his old-fashioned rectilineal bombing from any practical altitude in the face of the latest high-velocity A.A. artillery (where such is to be found!) is a suicidal ignoramus, and at the same time the writer, though no advocate of the "abolish the battleship" school of thought, confidently prophesies some very rude shocks for admirals in the next war.

SHADOW FACTORIES IN BEING

(*Continued from page 447*)

case, the oil sump, the rocker mechanism, the priming system, the air intake pipes, and oil and petrol pipes.

The Standard Motor Company, next to be visited, have their factory close to the car works on the new Coventry By-pass. It was commenced at the beginning of August, 1936, and covers about 3½ acres.

Production of the cylinder heads and barrels is well under way, and 90 per cent. of the machines are installed. Heads and barrels start at opposite sides of the single large buildings, and gravity roller conveyors carry them up and down batteries of machines which are almost all of British make. There are 106 operations in machining a cylinder head. The rough forging weighs about 50 lb., and the completed job only 17 lb. A weight comparison for untouched and completed barrels is much the same as for heads.

A job which needs speed and accuracy is the screwing into the hot alloy heads of valve seat inserts and sparking plug adaptors. Stelliting of the steel exhaust valve insets is carried out nearby.

In the heat treatment section the cylinder barrels are nitrided after plating to a depth of 15 "thou.," a process which takes 72 hours. Later the head and barrel are screwed and shrunk together, a copper jointing ring being inserted for gas-tightness and a grip band (which is turned to form the bottom cylinder-head fin) being finally shrunk on for security. The copper rings are produced to a limit of 1 "thou.," which is exceptional for a soft metal.

Below the works floor all the services are housed in a most orderly manner—canteens, surgery, wash house, carpenters, scrap department, boiler house, etc.

At Birmingham the Rover Company, Ltd., are manufacturing connecting rods, pistons, valves and springs, and tappet and cam assemblies. The first set was completed on September 15 of this year. About 85 per cent. of the machine tools have been delivered, and inspection of important moving parts has received special attention.

The whole of the personnel have been collected and trained for the work in a matter of months.

Although the list of parts made is quite small, over 10,000 operations are required for one set.

Before machining, the master rod with test piece weighs about 47½ lb., while the finished part weighs only 11¾ lb. Auxiliary rods from 10¼ lb. are machined down to 2 lb.

As the manufacturers of aircraft as well as engines, the Austin Motor Company might be expected to have a very large shadow factory, and the new main building, for Battle production, is indeed vast. Only a vague idea of the size can be conveyed by the figures—1,530ft. long by 410ft. wide.

At one end of the building are large and small presses for aircraft parts. The various units take shape in parallel lines down the shop to be finally assembled at the aerodrome end. Engine mountings are made, as well as wings and fuselage, and there is a stores section for the engines—Merlin I's to start with, and Merlin II's later on.

Completed Battles will first be wheeled to the flight shed at one end of the factory and then moved by lift to the flying field for tests prior to handing over to the R.A.F. Asphalt runways have been laid down on the aerodrome, which was levelled in the first place by German prisoners of war.

Some 50 per cent. of the parts for Battles are, so far, being manufactured, about half the equipment having been installed. The co-operation of the Fairey Aviation Company with the Austin Company has resulted in valuable experience in production being obtained.

Two separate sections deal with the Mercury engines, one for production of crankshafts, reduction gears, and v.p. controls, and another for assembling and testing one-half of the engines to be produced by the shadow factories. The remaining half of the Mercury engines will be tested by the Bristol Company in new specially erected premises at their works at Bristol.

At Birmingham the Austin test beds are now ready for operation. An engine is first run in by an electric motor for about five hours at 600 r.p.m., then passed on for acceptance test to the bed proper, which is of the latest U arrangement, and has a handsome grouped instrument panel away from the noise and heat of the engine on test.

Under the shadow scheme a very large factory to produce Bristol Blenheims is being erected at Speke, near Liverpool, which will be managed by Rootes Securities, Ltd. Other factories for the production of airscrews, carburettors, and magnesium are also included in the group.

COMPRESSIBILITY

Mr. C. N. H. Lock Discusses its Effects on High-speed Flight

THAT the time has come when the aircraft designer must begin to take into account the possibility that local velocities over certain parts of his aircraft may approach and even reach the speed of sound is stressed in the paper which Mr. C. N. H. Lock is presenting to the Royal Aeronautical Society this evening. Mr. Lock states that somewhere between the velocity of sound and one-half to three-quarters of this velocity there will be a rapid increase in drag coefficient as a result of the formation of local shock waves.

Space does not permit of giving the paper in full, and, anyway, it is probably a little too advanced to be followed by the average reader, but the conclusions with which Mr. Lock sums up are of interest and are reproduced in full:—

The main conclusion which has emerged from this discussion of possible effects of compressibility of the air, is that it is very desirable when designing an aircraft to avoid points of high local velocity at which the local velocity of sound may be exceeded. A good deal of information on this point may be deduced by the consideration of certain simple shapes for which the flow can be calculated by elementary methods.

The five shapes shown in Fig. 2 have all the same theoretical maximum local velocity of 1.20 times their forward velocity. The elliptic cylinder is thicker than the lenticular shape and therefore for a given thickness has a lower maximum velocity than the lenticular cylinder (double circular arc) and therefore presumably a higher shock stalling speed.

This last comparison is of interest because it has been generally supposed that a sharp leading edge is an advantage in avoiding increase of drag due to compressibility and the lenticular shape was tried on model high tip speed airscrews without success. It is true that when the forward velocity of the whole body exceeds the velocity of sound by a certain margin a shock wave will inevitably be formed in front of the leading edge of the aerofoil and the lenticular form will then very probably have the advantage of reducing to zero the interior part of the shock wave normal to the stream. When the general velocity is below the velocity of sound the shock wave tends to form opposite the maximum section and this explains the advantage of the elliptic over the lenticular.

In practice, the advantage of the ellipse is offset by the risk of a breakaway at the rear: this can be prevented by the addition of a tail as shown. The tests in the American high-speed tunnel suggest that the maximum thickness should be 0.4 chords from the leading edge, which is nearer the tail than

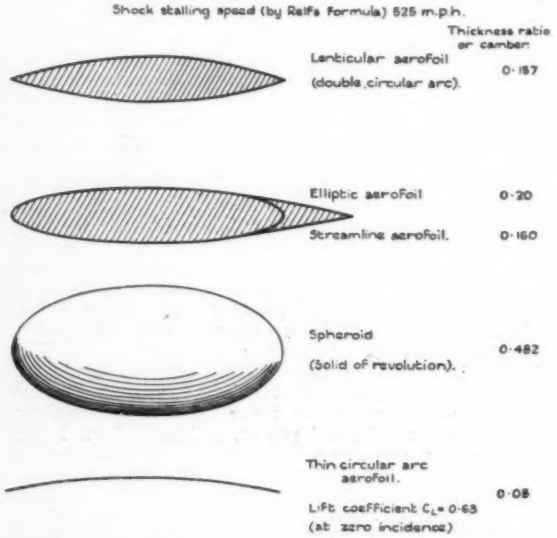


Fig. 2.—Series of shapes all having the same theoretical maximum increase of velocity (20 per cent.) at low speeds.

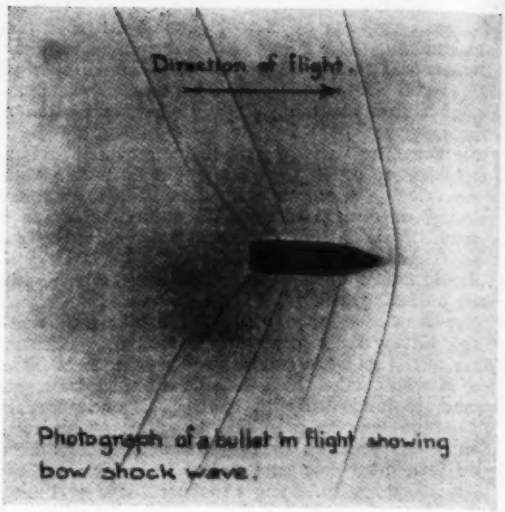


Fig. 1.

the position for the usual Joukowski section; accordingly, for the purpose of the present report, a streamline shape is obtained by adding to an ellipse a tail of 25 per cent. of the original chord length. Any further blunting of the leading edge as compared with the ellipse will cause the maximum velocity to occur on the shoulder before the maximum thickness is reached, and the shape will therefore be worse than the ellipse for the same thickness.

The elliptic cylinder will next be compared with the three-dimensional body of revolution of similar cross-section (the ovary spheroid). The figure shows a comparison between an elliptic cylinder and a spheroid, which gives the same maximum local velocity and shows that the spheroid can be much fatter than the cylinder for the same shock stalling speed. In practice a streamline tail would also be necessary in the case of the spheroid.

So far the question of lift has not been mentioned, but a certain increase of velocity on the upper surface for a given lift is unavoidable. The minimum increase of velocity apart from considerations of strength (and maximum lift) is probably given by the thin circular arc at zero incidence.

With this shape a lift coefficient (C_L) of 0.63 can be obtained with a velocity increase of 20 per cent. so that a coefficient of 0.1 appropriate to top speed requires an increase of only 3 per cent.

The above comparison is extended in the table which gives comparative thickness ratios of streamline and elliptic aerofoils and of spheroids having the same maximum velocity. The table also shows the speeds at which a critical increase of drag would be expected to commence. Those speeds are calculated by a formula due to Mr. Relf which requires further experimental confirmation. The speeds are likely to be too high rather than too low, but their relative values may be a useful guide.

We may now take a complete aeroplane and consider what are the points at which the maximum velocities are likely to

ELLIPTIC AEROFOILS, STREAMLINE AEROFOILS, AND SPHEROIDS HAVING THE SAME THEORETICAL SHOCK STALLING SPEED.

Fineness Ratios.			Theoretical maximum velocity ratio.	Theoretical shock stalling speed by Relf's formula; m.p.h. at high altitude.
Symmetrical Streamline aerofoil.	Elliptic aerofoil.	Spheroid.		
0.25	0.31	0.69	1.31	470
0.20	0.25	0.57	1.25	500
0.15	0.18	0.46	1.19	530
0.10	0.125	0.29	1.12	570
0.05	0.062	0.21	1.06	630

Fig. 3.—A typical fuselage of fineness ratio 0.143. It is an approximate body of revolution. The fineness ratio of the equivalent spheroid is 0.26. The theoretical shock stalling speed by Relf's formula is 600 m.p.h.

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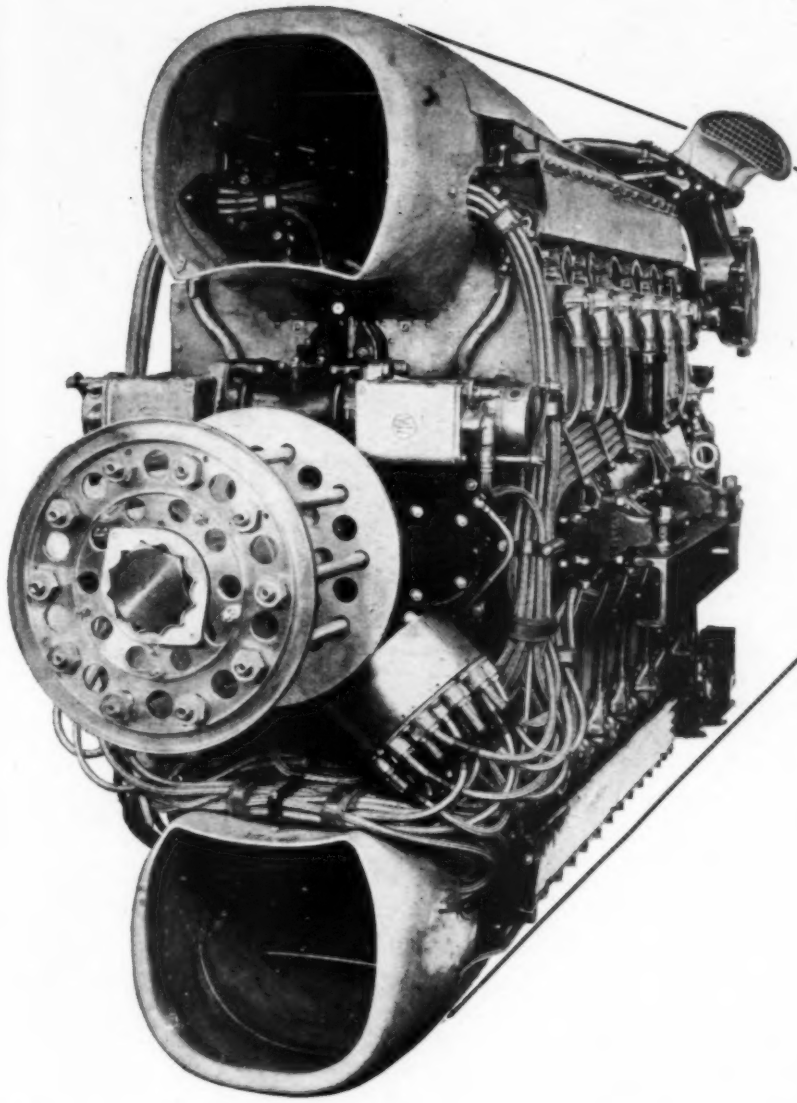

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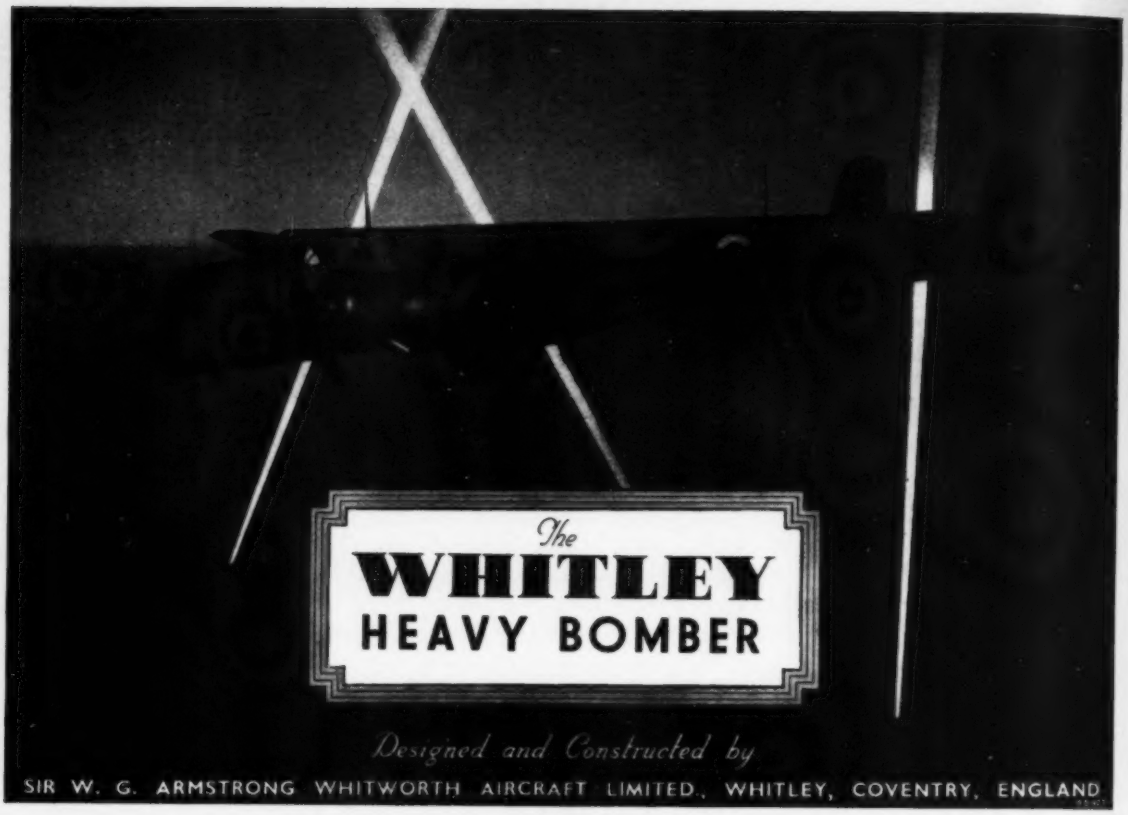

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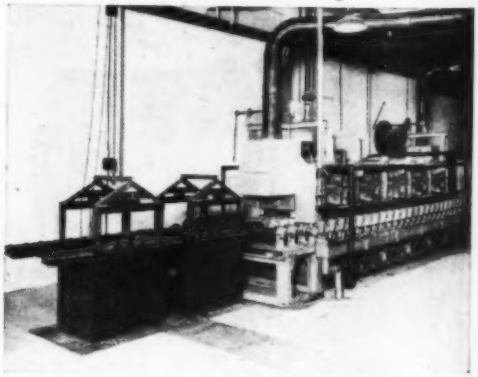

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occur and how these are to be reduced. The figure shows a typical fuselage of a high-speed aeroplane which approximates to a streamline body of revolution of fineness ratio 0.14. The shape of the forward portion approximates to that of a spheroid of fineness ratio 0.26 so that the critical speed should be as high as 600 miles per hour. This speed will, of course, be reduced by the presence of any irregularities in the outline, but it represents a possible ideal figure.

The C_L at top speed of a high-speed machine need not exceed 0.1, so that the limiting speed would still be very high (660 m.p.h.). The most definite limitation would appear to be the necessity for structural strength of the wing. Thus if a thickness of 20 per cent. is inevitable in the cantilever monoplane the limiting speed is reduced to 500 m.p.h. If this figure (20 per cent.) represents the maximum thickness of a tapered wing, however, the limiting speed would be somewhat raised since the tapered wing will evidently approximate slightly towards the three-dimensional form. The ideal shape is an ellipse with streamline tail and with centre line slightly cambered to suit the value of C_L at top speed, and this is, in fact, the shape commonly used in practice, except that the maximum thickness should be at 0.4 chords from the leading edge.

It might be suggested that since an increase of incidence from the value zero (assumed to correspond to maximum speed) rapidly increases the maximum value of q^2/V^2, the tendency towards a shock stall might increase, but actually a numerical investigation shows that the reduction of V with increase of incidence more than compensates for the increase of (q^2/V^2). Thus, when guarding against the shock stall, it is unnecessary to consider forward speeds lower than the top speed. It is, of course, necessary to consider the ordinary stall when designing the wing.

Airscrew Problems

So far the airscrew has been deliberately excluded, but it is evident that it may be useless to design an engine nacelle of such a shape as to avoid a shock wave if shock waves are produced by the airscrew blade roots. Apart from body interference, the air speed over the blade roots of even a very high-pitch airscrew will be higher than the forward speed of the machine so that there is considerable risk of the formation of shock waves on the relatively thick blade roots.

An attempt has been made to estimate how far the conclusions as to limiting forward speeds are modified by consideration of the airscrew (Fig. 4). In order to arrive at the most favourable case the thin-bladed screw used on the 1931 Schneider Cup machine was taken as the prototype for the thickness chord ratio at various radii. The shock stalling speed of various sections was estimated on the basis already described, and is shown by the dotted curve. On the same diagram are shown the actual air speeds at various radii of an airscrew assumed to have a true tip-speed of 670 m.p.h. (0.95 times the velocity of sound) for various forward speeds. The sections near the tip of the screw will form a shock wave in all cases. A shock wave at the root reaches a radius of 0.3 for a forward speed of 500 and rapidly spreads outwards with increasing speed until at a forward speed of 530 m.p.h. the whole screw carries a shock wave. Hence, even if it is assumed that shock waves near the tip do not spoil the drag of a nacelle there will still be a limit of the order of 400 m.p.h. above which shock wave effects at the surface of the body will have to be considered. The following suggestions may be made in this connection:—

As much as possible of the blade roots should be shielded by a spinner.

The exposed portion of the roots should be made as thin as possible.

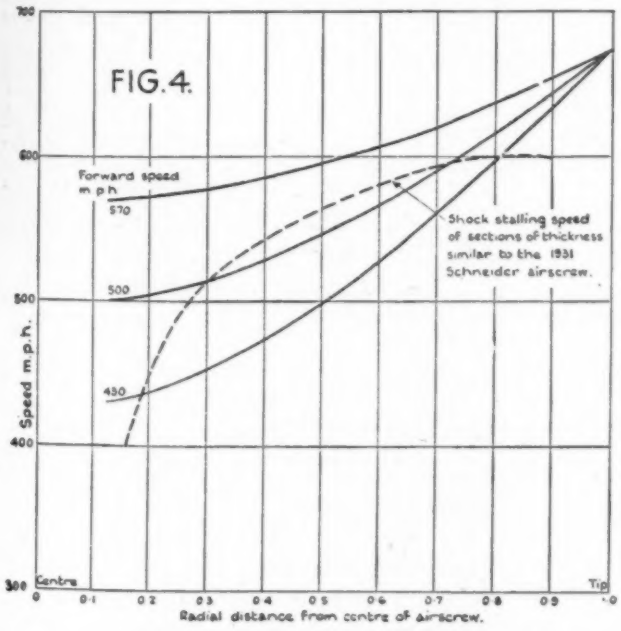
It may be desirable to make the rear of an engine nacelle of a fairly bluff shape in order to reduce the velocity over the blade roots.

It appears that the study of airscrew-nacelle interference at high speed will be one of the most difficult of future experimental researches. In the future it is possible that the difficulty will be ultimately overcome by the use of jet or rocket propulsion.

The next point to consider is the cooling of the engine, and here the advantage of ducted cooling becomes evident. There seems to be no reason why the withdrawal of cooling air through suitably designed intakes in the leading edge of wing or fuselage should involve the introduction of additional high-velocity spots. The use of the ordinary cowled engine may, however, involve inevitable high-velocity regions over the shoulder of the cowl because of the limitation of distance between the airscrew and the cylinders, and this would be a useful point for future investigation. For a typical cowl the critical speed appears to be about 450 miles per hour. It is evidently difficult to calculate the velocities round any form of air intake, but the following consideration should be a guide. If we take a known shape such as a spheroid and make a hole in the nose and suck air in through it, it is arguable that the maximum velocity will be slightly decreased and the critical speed for drag increased.

Proceeding to the question of minor details it is evident that the avoidance of the compressibility stall forms an additional reason for the avoidance of all casual excrescences and roughnesses as any such will form a potential source of shock wave formation. As an extreme case a bluff obstacle such as a circular cylinder will inevitably form a shock wave at a speed of less than 350 m.p.h.

In discussing the question of engine cooling no mention has so far been made of the inevitable increase of temperature of the cooling air resulting from the high speed of the aircraft. In the case of ducted cooling the velocity of air in contact with the engine is considerably below that of the aircraft, and



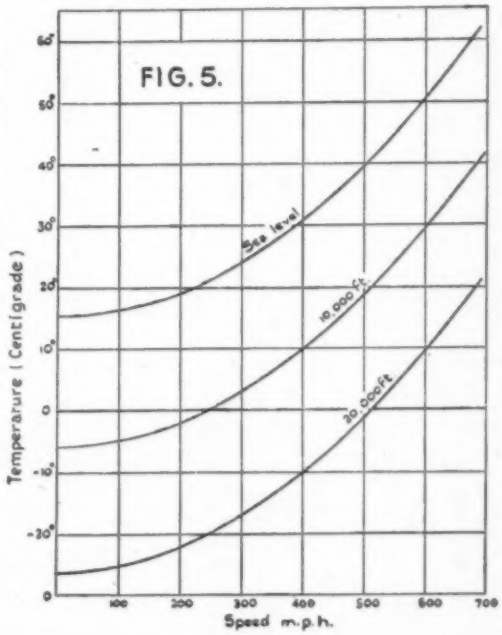


Fig. 4.—Curves showing the speed over the various sections of the blades of airscrews having a true tip speed of 670 m.p.h. and various forward speeds. Fig. 5.—"Stagnation Temperature" on an aircraft for various forward speeds and heights.

its temperature on reaching the engine will approach that of air brought to rest adiabatically, which may be easily calculated. The results are shown by the curves (Fig. 5) from which it is evident that a considerably greater quantity of cooling air is necessary on a high-speed aircraft at sea level than would be required if the cooling air were at atmospheric temperature. At high altitude the rise of temperature is avoided but the available mass of air is reduced.

The more definite of the above conclusions are included in the table below, in which various principal features of a machine are placed in a kind of order of merit. The earlier the entry appears in the table the higher the speed at which

Order of Merit of Various Features of an Aircraft.

		Fineness ratio.	Theoretical shock stalling speed by Reif's Formula; m.p.h. at high altitude.
1.	Thin circular arc (C_L 0.1)	—	660
2.	Typical fuselage	—	605
	Streamline body of revolution with spheroidal nose	0.14 0.26	— —
3.	Symmetrical aerofoil sections	0.12	550
4.	Maximum thickness 0.4	0.20	500
5.	Chords behind leading edge	0.24	470
6.	Typical engine cowl	—	450
7.	Sphere	—	400
8.	Circular cylinder	—	340

serious effects of compressibility will commence. It is necessary to repeat that the actual speeds reached depend on a theoretical formula of uncertain accuracy; in the one or two cases in which experimental evidence exists, the speeds given correspond to an increase of drag coefficient of about 50 per cent.

The first item shows that ideally the production of lift at top speed presents no difficulty. If a thin circular arc of suitable camber could be used the critical speed would be as high as 660 m.p.h. Next in order comes a typical well streamlined fuselage. The first factor to cause difficulty is the need for a finite thickness of wing section on account of strength and to allow of a moderate landing speed. Strength requires a thick central section in a tapered cantilever wing, but the limiting speed of a tapered wing will certainly be higher than that of the uniform wing specified here for the same maximum thickness.

The worst item is the typical engine cowling for a radial air-cooled engine. It would appear that the use of ducted cooling should be capable of overcoming this difficulty, but the problem is complicated by the uncertainty as to the effect of the airscrew blade roots.

The sphere and cylinder are added as examples of features to be avoided at all costs.

In general it would appear that the features that are desirable for attaining high compressibility stalling speeds are similar to those tending to low drag at ordinary speeds, but with certain important exceptions. For example, good streamlining will not increase the shock stalling speed of a thick-section wing beyond a definite limit depending on the thickness.

D.H.'s Chief Test Pilot

MR. GEOFFREY DE HAVILLAND has been appointed chief test pilot of the De Havilland Company.

The eldest of Captain de Havilland's three sons, all of whom are on the staff of the company in different capacities, Mr. de Havilland joined the organisation in January, 1928, at the age of eighteen and obtained three years of technical training as an apprentice, afterwards learning to fly in the R.A.F. Reserve at Stag Lane and spending some months in South Africa. On his return in 1932 he was appointed an instructor to the Technical School, transferring to the London Aeroplane Club as an instructor in September, 1933. In January, 1935, he joined the Test Pilots' Department of the company under Capt. Hubert Broad and he has shared the senior test-piloting duties with the late Mr. R. J. Waight since September, 1935.

Mr. de Havilland holds "A" and "B" licences (as well as G.E. "A" and "C" licences), and in 2,700 hours of flying he has had experience of all the D.H. types and of a number of others. He made the first test flight of the Don trainer in June this year, and has since conducted the entire flying trials of this new machine. Lately he has put in many hours on the Albatross, which is now in its final prototype stages.

"The Wireless World"

AS from this week's issue, the "New Readers' Number" dated November 4, our associated journal, *The Wireless World*, will be published on Thursday of each week instead of Friday as hitherto.

Portsmouth Sub-contract Activity

MANY readers of *Flight* know that the firm of R. K. Dundas, Ltd., of the Airport, Portsmouth, have for some years specialised in marketing British aircraft, engines and equipment in India—in which connection, incidentally, they are shortly to produce a veritable *magnum opus* of a catalogue, complete with prices in rupees.

What is not, perhaps, so generally known is that at Southsea they have a factory, officially approved, now undertaking sub-contract (A.M.705) work for the majority of manufacturers in this country. The items which they are equipped to produce include components and complete assemblies, tanks, cowlings, and precision-made jigs and tools.

Among processes operated are welding, sandblasting, heat treatment and normalising.

Gyroplane and Autogiro

IN reply to Dr. Bennett's comments on Herr Hafner's paper, published in *The Aircraft Engineer* section of *Flight* last week, we have received from Herr Hafner a communication in which he challenges some of Dr. Bennett's statements and conclusions. Unfortunately, Herr Hafner's article arrived too late to be included in this week's issue; it will be published next week.

Mr. A. T. S. Groombridge

THE Dumbarton factory of Blackburn Aircraft last week said good-bye to its works manager—Mr. A. T. S. Groombridge—when he left for the south to take up a similar post with Phillips and Powis Aircraft, Ltd. He was presented with a silver punch-bowl by the Dumbarton staff as a token of appreciation and goodwill.

Mr. Groombridge, in his acknowledgment of the gift, said that the success of any planning, layout and building of the factory had been due more than anything else to the support he had been given by everyone there. All his staff had, at different times, played their part in the building of the Clyde Factory, which had been completed in what is undoubtedly record time for this country. He hoped they would give to Mr. Wilson, his successor, all the support that they had given to him.

Forthcoming Events

November 4. R.Ae.S. Lecture*: "Problems of High-Speed Flight as Affected by Compressibility," by Mr. C. N. H. Lock.
November 5. R.Ae.S. Students' Section: Informal Supper.
November 8. British Air Line Pilots' Association: Inaugural Dinner, Dorchester Hotel, London.
November 12. Norfolk and Norwich Aero Club: Annual Ball.
November 12. R.Ae.S. Coventry Branch Lecture (with Coventry Engineering Society): "C.-I. Aero Engines." by Mr. A. Swan, Technical College Theatre.
November 16. Institute of Transport: Brancker Memorial Lecture: "Civil Aviation as a World Force," by Lord Sempill. Institution of Electrical Engineers, 6 p.m.
November 16. R.Ae.S. Students' Section Lecture: "Wing Flutter Problems," by Mr. P. B. Walker, R.Ae.S. Library, 7 p.m.
November 17. R.Ae.S. Weybridge Branch Lecture: "Light Alloy Castings and Stampings for Aeronautical Purposes," by Mr. W. C. Devereux. Vickers Senior Staff Canteen, 6.15 p.m.
November 18. R.Ae.S. Lecture*: "The Take-off Problem," by Mr. H. F. Vessey.
November 19. Scottish Flying Club: Annual Ball at Central Hotel, Glasgow.
November 19. Sheffield Aero Club: Annual Dinner and Dance, Grand Hotel, Sheffield.
November 25. C.A.S.C.: Dance, First Avenue Restaurant, London, W.C.1.
November 25. R.Ae.S. Coventry Branch Lecture: "Clouds," by Dr. R. C. Sutcliffe, Liberal Club, Union Street, 8.15 p.m.
November 26. Lancashire Aero Club: Annual Ball, Palace Hotel, Buxton (9 p.m.), and Car Rally in conjunction with Lancs and Cheshire Car Club.
December 1. R.Ae.S. Weybridge Branch Lecture: "Large Aeroplanes," by Dr. H. Roxbee-Cox. Vickers Senior Staff Canteen, 6.15 p.m.
December 2. R.Ae.S. Lecture*: "Wing Surface Controls with Reference to Possible Developments in Flying Technique," by Ft. Lt. H. P. Fraser.
December 2. Herts and Essex Aeroplane Club: Annual Dinner and Dance, Park Lane Hotel.
December 7. Colleges of Automobile and Aeronautical Engineering: Annual Dinner and Dance, Grosvenor House, London.
December 10. Strathtay Aero Club: Annual Ball, Salutation Hotel, Perth.
December 17. London Aeroplane Club. Dinner and Dance, Park Lane Hotel, London.

* All these lectures take place at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1, beginning at 6.30 p.m.

The prototype Handley Page Hampden medium bomber. A development of this machine is mentioned in a paragraph overleaf.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News : Official Announcements : Military Aviation Abroad

R.A.F. Armistice Ceremony

THE Chief of the Air Staff, Air Chief Marshal Sir Cyril Newall, K.C.B., C.M.G., C.B.E., A.M., will lay the Royal Air Force wreath on the R.A.F. War Memorial, Victoria Embankment, at 11 a.m. next Sunday.

Members of the Comrades of the Royal Air Forces Association, with the Royal Air Force Band and a guard of honour, will be drawn up in square across the road in front of the Memorial for inspection by the Chief of the Air Staff at 10.50 a.m.

A short service will follow, conducted by the Chaplain-in-Chief of the Royal Air Force, the Rev. J. R. Walkey, C.B.E., M.A., K.H.C., and will terminate with the Last Post, which will mark the beginning of the two minutes' silence before 11 a.m.

At 11 a.m. the Chief of the Air Staff will lay the wreath and he will be followed by the representatives of the Dominions, the Comrades of the Royal Air Forces Association and the Women's Royal Air Force Association.

Royal Air Force trumpeters will sound the Reveille and the Comrades of the Royal Air Forces Association will march past the Memorial to conclude the ceremony.

A Nursing Appointment

THE Air Ministry announces that Matron Miss Emily Mathieson Blair has been appointed Matron-in-Chief, Princess Mary's Royal Air Force Nursing Service, with effect from January 16, 1938, in place of Miss Katherine Christie Watt, C.B.E., R.R.C., the latter being placed on the retired list.

Matron Miss Emily Mathieson Blair received her general training at the Western Infirmary, Glasgow, served with Queen Alexandra's Royal Naval Nursing Service Reserve during the war and was appointed to the Royal Air Force Nursing Service in December, 1918. She was promoted to the rank of Senior Sister in January, 1925, and to Matron in January, 1927. Miss Blair has held appointments as Matron of Royal Air Force hospitals at home and in Palestine and Iraq; she is at present Matron at the Royal Air Force Hospital, Cranwell, Lincs.

Reunion Dinners

THE nineteenth annual reunion of the ship's company of H.M.S. *Engadine* will be held at The Princess Louise, 208-9, High Holborn, London, W.C.1, on Saturday, November 13, at 6.30 p.m. Full particulars from Mr. Arthur B. Ward, 19, Cursitor Street, London, E.C.4.

* * *

The annual dinner of the Old Cranwellian Association will be held in the Connaught Rooms, Great Queen Street, Kingsway, London, W.C.2, on Saturday, November 27, at 8 p.m. for 8.30 p.m. Any member of the Association who has not received an invitation, and who desires to attend, should communicate with the Secretary, Old Cranwellian Association, Royal Air Force College, Cranwell.

A reunion dinner of officers, past and present, of No. 1 Squadron, R.F.C. and R.A.F., will take place on Friday, November 26, at the Savoy Hotel, London, at 8 p.m. Tickets will be 12s. 6d. each, exclusive of wines. Any member of the squadron who has not yet received a notice should communicate with F/O. P. J. Sanders, Royal Air Force, Tangmere, Chichester, Sussex.

* * *

Mr. T. W. J. Nash, A.F.M., is endeavouring to collect the names of those who served with No. 84 (Bomber) Squadron at Shaibah and who are interested in a proposed reunion dinner. This will be held as soon as sufficient support is obtained. Mr. Nash, to whom those interested should address their letters, is to be found at Nash Aircraft Sales, Airport of London, Croydon.

* * *

The fifth reunion dinner of the officers of No. 203 (F.B.) Squadron will be held at 7.30 p.m. on Friday, December 3, at the Royal Air Force Club, 128, Piccadilly, London, W.1. Air Vice-Marshal W. L. Welsh, C.B., D.S.C., A.F.C., will preside. The committee of the Royal Air Force Club have offered the privilege of honorary membership for the night to those officers who are not members. The price of tickets, excluding wines, will be 12s. 6d. each. Dress will be dinner jackets. Guests may be invited provided they have been associated with the work of the squadron in the Persian Gulf. Those officers intending to be present should notify Wing Cdr. J. S. Chick, M.C., A.F.C., Headquarters, Bomber Command, Royal Air Force, Hillingdon House, Uxbridge, Middlesex.

* * *

Many original members of No. 27 Squadron, R.F.C., attended the nineteenth annual reunion dinner at the Barley Mow Hotel, London, on Saturday, October 16. The chair was taken by Group Capt. Sidney Smith, D.S.O., A.F.C.

At the commencement a short silence was observed in memory of an old member, Wing Cdr. P. C. Sherren, M.C., who was accidentally killed while competing in the King's Cup Race.

During the evening the President, Major Douglas Hill (Hussars and R.F.C.), sang the Squadron song, accompanied by "Alphonse"—Lt. H. I. Fordred, 1/3 London Regt., Royal Fusiliers, and R.F.C., who composed the music in France and, in collaboration with Capt. Raworth and Capt. Ivor Stockwood, the lyrics. Last year the song was printed and presented to the present Squadron Commander, who took it to India, where it has become the song of the present No. 27 (B.) Squadron.

Flying Accidents

THE Air Ministry regrets to announce that Sergt. Jack Norman Bushnell and L.A/C. George Oswald Carr lost their lives in an accident which occurred at Lachi, near Kohat, on October 25, to an aircraft of No. 27 (Bomber) Squadron, Kohat, India.

The Ministry also regrets to announce that Wing Cdr. Aubrey Robert Maxwell Rickards, O.B.E., A.F.C., P/O. Robert Henry McClatchey, and A/C.1 Leslie George O'Leary, lost their lives as the result of an aircraft accident which occurred at Khor Gharim, Iraq, on October 30.

A Napier-engined Bomber

AN improved version of the Handley Page Hampden medium bomber is in production at the new Short and Harland works in Belfast. So far unnamed, the new machine will differ from the prototype Hampden in that it will mount a pair of the new Napier E.108 engines. The E.108 is a development of the current Dagger series and was shown in public for the first time at the S.B.A.C. Display this year. Of 16.8 litres capacity, it has provision for a D.H. constant-speed airscrew and has front and rear ends of entirely new design. To cope with the increased power output the fin area has been greatly increased.

The machine itself is likely to be generally similar to the Hampden L.7271, which demonstrated at the S.B.A.C. Display.

And a Reconnaissance Floatplane

THE Fairey Seafox light reconnaissance seaplane is another standard Service type fitted with a Napier air-cooled engine of "H" formation. A two-seater with metal-covered fuselage and fabric-covered folding wings, the Seafox is a lightly loaded biplane with very comprehensive slinging gear, sprung floats and provision for catapult launching. Powered with the moderately supercharged Napier Rapier VI (395 h.p. max. at 5,800 ft.) the top speed is 123.5 m.p.h. and the all-up weight 5,424 lb.

School of Naval Co-operation

THE School of Naval Co-operation will move on January 1, 1938, from Lee-on-the-Solent to the new station at Ford, near Arundel. This station will open on December 1 and will be placed in No. 17 (Training) Group of the Coastal Command.

The School of Naval Co-operation trains only naval observers, who are officers and ratings of the Royal Navy, and the former do not hold commissions in the R.A.F. as naval pilots do. The question of which R.A.F. stations are to be made over to the Admiralty for use of the Fleet Air Arm is now under discussion.

Warrant Officers Commissioned

THE undermentioned warrant officers have been granted permanent commissions in the equipment branch:—

A. W. Bridger, L. A. McIntosh, A. H. Gee, H. J. Bartlett, M. J. Sullivan, R. C. Kitchin, E. J. Adams, L. G. Wheeler, T. C. Wharfe, J. E. Linford, W. H. Crowe, H. C. Manuel, G. W. Salt, W. P. Williams, A.F.M., L. S. Rutley, A. V. Ebert, G. F. Dell, D. L. Eden, A. H. Brown, D. D. M. Davies, H. Corfield, M.M., C. J. Hutton, F. E. Bastin, H. Gedd, C. Stonebridge, E. G. Edmonds, F. J. Gracey, I. E. Phillips, F. P. Gee, H. B. B. Burns, R. A. Harvey, J. K. Osborne, E. R. Hoare, A. E. White, R. D. Robinson, D.C.M., McD. B. Manson, D. Holbrook.

Royal Air Force Gazette and Intelligence

London Gazette, October 26, 1937

Sqn. Ldr. S. D. Macdonald, D.F.C., is granted the acting rank of Wing Commander (unpaid) (October 20); F/O. A. R. Fane de Salis is granted the acting rank of Flight Lieutenant (October 1); Flt. Lt. D. W. Reid is seconded for duty with the British Military Mission, Egypt (October 8); Sqn. Ldr. P. D. Cracroft, A.F.C., is placed on the half-pay list, scale B, from January 5 to 9, and from March 26 to March 31 inclusive; Sqn. Ldr. I. Cullen, M.B.E., A.F.C., is placed on the retired list (October 15).

Royal Air Force Reserve

Reserve of Air Force Officers

General Duties Branch

The seniority of the following Flight Lieutenants is antedated to April 1, 1936:—L. E. Vine, W. F. Murray.

Royal Air Force Volunteer Reserve

Medical Branch

J. M. Bickerton, M.R.C.S., L.R.C.P., B.Ch., F.R.C.S.(E), is granted a commission as Squadron Leader with effect from October 26.

Auxiliary Air Force

General Duties Branch

No. 602 (CITY OF GLASGOW) (BOMBER) SQUADRON.—Flt. Lt. A. D. Farquhar is promoted to the rank of Squadron Leader and appointed to the command of the squadron (October 26).

Equipment Branch

Flt. Lt. W. B. Frederick (R.A.F., Retired) is granted a commission in that rank (August 30).

Medical Branch

No. 605 (COUNTY OF WARWICK) (BOMBER) SQUADRON.—Flt. Lt. J. S. Jerome, M.C., M.A., B.M., B.Ch., is promoted to the rank of Squadron Leader (July 4); Sqn. Ldr. J. S. Jerome, M.C., M.A., B.M., B.Ch., relinquishes his commission on completion of service and is permitted to retain his rank (July 5). (Substituted for notification in *Gazette* of August 24.)

General List

Sqn. Ldr. D. F. McIntyre, A.F.C., is appointed to the General List in the rank of Squadron Leader on relinquishing command of No. 602 (City of Glasgow) (Bomber) Squadron (October 26).

Appointments

General Duties Branch

Wing Commanders.—O. R. Gayford, D.F.C., A.F.C., to Headquarters, No. 2 (Bomber) Group, Andover, for Air Staff duties, 11.10.37. L. G. Harvey, to Directorate of Repair and Maintenance, Air Ministry, 4.10.37.

Squadron Leaders.—J. D. Breakey, D.F.C., to Directorate of Intelligence, Air Ministry, 4.10.37. H. E. Forrow, O.B.E., to No. 18 (Bomber) Squadron, Upper Heyford; to command, 11.10.37. R. Menzies, to Headquarters, No. 3 (Bomber) Group, Mildenhall; for Signals duties, 11.10.37. E. G. C. Stokes, to No. 2 Balloon Training Unit, Rolleston Camp; to command, 11.10.37.

Flight Lieutenants.—J. R. A. Peel, to No. 601 (County of London) (Fighter) Squadron, Hendon, 4.10.37. H. E. Dicken, to Home Aircraft Depot, Henlow, 11.10.37. A. G. Adams, to No. 4 Flying Training School, Abu Sueir, Egypt, 1.10.37. W. N. Ash, to No. 139 (Bomber) Squadron, Wyton, 11.10.37. H. M. T. Neugebauer, to No. 204 (General Reconnaissance) Squadron, Mount Batten, 8.10.37.

Owing to the greatly increased length of these lists as a result of R.A.F. expansion, ranks are confined to those of Flight Lieutenant and above.

A Dornier Do. 17 medium bomber of the German Air Force. Powered with two Mercedes inverted vee-twelves, the Do. 17 is said to be faster than a Blenheim. It has a gun position behind the pilot's cockpit.

FOREIGN SERVICE NEWS

260 m.p.h. Soviet "G.P."

BOGDANOW, the Russian aircraft constructor, has produced a two-seater general purpose machine with an 840 h.p. M-34 engine. The all-up weight is 5,280 lb. and the top speed 260 m.p.h. Should the results of official trials come up to expectations the machine will be put into large-scale production.

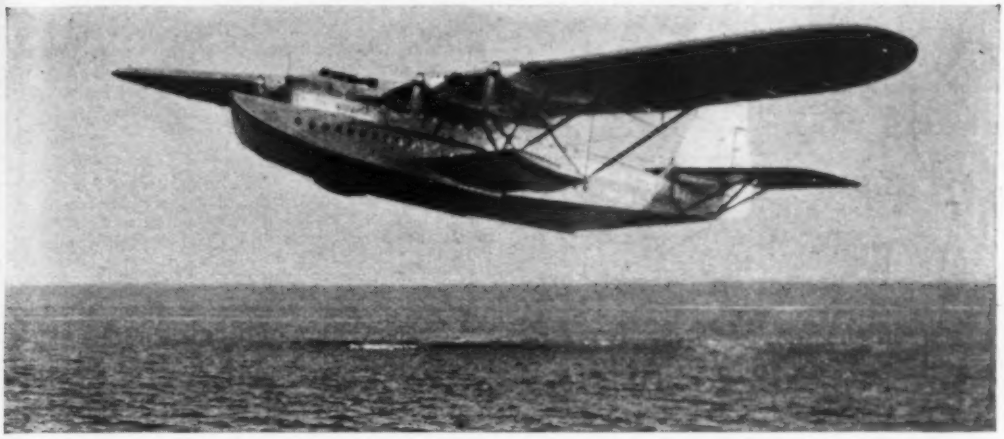
Tests of the Bell Pusher

THE Bell Aircraft Corporation has completed preliminary contractors trials with the XFM-1 twin-engined, multi-seater fighter monoplane, and has turned the machine over to the U.S. Army Air Corps for official trials at Wright Field. This machine has pusher airscrews driven by Allison glycol-cooled engines of 1,000 h.p. each.

Netherlands Defence

THE Fokker concern figures largely in the proposed orders for new military aircraft by the Netherlands Air Force. It seems that the Defence Estimates (including the Air Estimates) will not be passed before January or February next year, but in order to save time the Government has placed provisional orders for rather more than a hundred machines. Probably these will include 34 fighters of the Fokker D.21 type for the protection of reconnaissance machines and bombers and for co-operation with the army; 34 improved G.1 two-seater twin-engined "destroyers" (the prototype, *Le Faucheur*, was introduced at the last Paris Show) intended primarily for the destruction of bombers; 26 heavy bombers of the T.5 series, half of which are already in production; and eighteen Dornier flying boats for the Netherlands Indian Air Force. These last are said to be of the very latest three-engined type and will be built under licence by the Aviolanda works.

COMMERCIAL AVIATION



RECORD-BREAKER: The Latécoère flying boat *Lieutenant de Vaisseau Paris*, looked upon in many quarters as a white elephant, has just proved its particular efficiencies by breaking the world's flying-boat long-distance record, which was previously held by an American Consolidated boat. The *Lieutenant* flew 3,612 miles from Kenitra (Morocco) to Maceio (Brazil) in 36 hours. At the time of going to press she was on her return journey.

THE WEEK AT CROYDON

Strange Police : A Loading Calculator : Air Ministry Control : Damp and Insoluble

THE Sunday before last, when Miss Jean Batten came in—and pleased we were to welcome her after her magnificent flight—the authorities called in the Metropolitan Police. The show they put up was but moderate. People with no business there were allowed on to the field in fairly large numbers, and people who *had* business were stopped.

The system was carried to perfectly fantastic lengths, and I believe that uniformed members of companies whose duty it was to be on the tarmac were actually prevented, temporarily at least, from going about their lawful occasions. If strange (I will not say very strange) police are to be brought to the airport they should first be given a course of instruction, but most people would far prefer the Wallington police—just as efficient, by the way, and with some knowledge of the aerodrome and its ways. I hear that what might have been expected actually happened, and the police were, of course, taken by surprise. The crowd broke through from the public enclosure. Incidentally, the Press camera people, who were only doing their job, were not too pleased with the way the police arranged things and the treatment meted out to them.

Railway Air Services carried a connection passenger for Holland one day last week. The pilot sent a message asking K.L.M. to wait, and, in the circumstances, the Dutch company did. The precedent seems a dangerous one, however, for whether passengers reach Croydon by road or air, it is up to them to arrive in time, and it is by no means "pro bono (air travelling) publico" to wait for them. Sometimes, however, when it is certain that the machine will be ahead of schedule at the other end, a few minutes' delay is perhaps permissible.

News comes to hand of a new aircraft instrument of considerable importance to air operators. It is called the Librascope, and it gives at all times the total weight of the load and the exact centre of gravity of a machine. The Librascope weighs only 3-5lb., and when in flight a check can be made at any time of the change in C.G. position due to the emptying tanks. The loading of modern machines becomes, or tends to become, increasingly complicated and delicate, and many an airport loader must be transfixed with envy even to the point of missing his train to see porters hurling huge trunks, baskets of eggs, live Great Danes and crates of dead rabbits into a guard's van irrespective of the centre of gravity—and, incidentally, of the best interests of the company's clients. Loading becomes more and more the job for a Senior Wrangler (not Wangler), so precise and so complicated are the calculations required. As Senior Wranglers are everywhere being replaced by calculating machines, I understand, Professor Librascope, the robot calculator, will be a not unwelcome addition to our traffic staffs, if promise doth not outrun performance, and, from all I hear, performance seems likely to outrun promise.

One Master

It never seemed altogether sound to persuade or compel municipalities to appoint their own chief airport officers, who, as soon as the airport became of national importance, were bound to come under the Air Ministry. Cases occurred where three weeks' casual experience at Croydon was considered sufficient training for a municipal airport officer and, in other cases, some city engineer regarded the new official as being on a par with a municipal garbage-car inspector. In consequence, drawing on his experience of city tramways, the city engineer tried to run the airport much as the secretary of a golf club runs that other sort of wide open space—the airport manager having exactly as much say in the matter as the man who removes worm casts from putting greens. I note, therefore, with considerable satisfaction that the Air Ministry proposes to control all "key" aerodromes. Manchester has already been taken over, and the Ministry has now appointed Mr. Halliwell to look after Portsmouth; he has had two years' experience at Croydon.

There are rumours that the Burnelli flying wing, as some people call it, which is believed to be the property of Sir Hugo Cunliffe-Owen, will be demonstrated here by Mr. Clyde Pangborn.

Things become more and more thrilling in the main hall. The poster plastering of pillars advances apace, and huge scaffolds, reaching to the roof, are not erected, as some have supposed, in order that the perpetrator of the advertising scheme may make his last speech and confession therefrom. Nor, as has also been suggested, are they for the purpose of placing guaranteed waterproof advertising matter over the enormous wet patches which have appeared on the ceiling. Actually, so far as one can

gather, they have been erected so that the authorities can get a close-up view of the wet patches and remark, "Dear, dear," before going away and forgetting about the whole matter. A short time ago, because they wanted to paint and colourwash the corridors and to whitewash the ceilings, the attention of those concerned was drawn to the huge holes which had been bored years previously in order to let water through on to the concrete passage floor rather than allow it to collect between the roof and ceiling. Works and Buildings laid their heads together and a great scheme was evolved. Bits of three-ply were nailed over the holes and then the ceiling was whitewashed and the walls beautifully decorated. Alas, it has rained since then and the water has ruined both ceiling and walls. The authorities are grieved, and it is now rumoured that a junior W. and B. employee, promptly sacked for impertinence, has suggested mending the roof itself.

But, seriously, suppose one went to any city airport in Europe and said that Croydon's main and insoluble problem since the place had existed had been the difficulty of stopping the rain from pouring through the roof.

A. VIATOR.

The Air Ministry at Portsmouth

A SECOND provincial control centre has now been taken over by Air Ministry staff—Portsmouth. Details of the new scheme were given in last week's issue.

The "Antares" Loss

AT the time of going to press nothing had yet been heard of the missing Air France machine which was flying the mails between Dakar and Casablanca. This machine, a Dewoitine 333, *Antares*, left at dawn on October 27, carrying the usual mail from South America and a complement of six official passengers and crew.

Gold Coast Extension

THE West African air service has now been extended by Elders Colonial Airways from Lagos to Accra. The company is, in fact, made up of Elder Dempster shipping and Imperial Airways interests, and the service is being operated, under charter, by Imperial machines and pilots as an extension of the Khartoum-Lagos service.

I.A.F.'s Condors

APPARENTLY the three Curtiss Condors used by International Air Freight on their Amsterdam run are proving very satisfactory in service and, on the whole, the pilots like them. The control cabins are very roomy, the essential view is excellent and the instruments are well arranged.

From the operational point of view the only criticism seems to be that the machines are so quiet that the control people at Croydon have difficulty in giving the "motors over" signal during approaches in bad weather. Nevertheless, one of the Condors was brought in without much difficulty recently when other services landed elsewhere. Of course, the pilots of the passenger machines probably felt that their living freight was a little too valuable to take the slight risk involved, but the Condor pilot's job was certainly simplified by the machine's comparatively low-landing speed. Incidentally, the Condor is quite fast; its maximum is 170 m.p.h. or so.

A fourth machine is (see *Flight* of October 21) being rebuilt in Rollason's shops, and this is to have a specially wide (5-6 ft.) opening with a roll-top-desk type of door for the loading of really bulky articles like motor cars and battleships. It may be remembered that the Condor, though a conventional biplane, has such modern features as v.p. airscrews and a retractable undercarriage. The latter, designed in the days when people even over in America were not quite sure of them, has three independent methods of operation: normally by electric motor, by hand-lever in the cockpit, and, finally, if all else fails, the wheels can be lowered directly by "crow-bar" methods from the main cabin. The trimming gear is interesting in that the whole tail unit is movable.

Mr. C. S. Humphrey, who has been in charge of the erection, and is now in charge of the general maintenance, claims that, from his point of view, no machine could be more easily handled. The pilots at present flying the freight service are Messrs. G. R. Mack, W. L. Garner and S. Turner.

Imperial Airways Profit

LAST week, Imperial Airways announced a net profit of £164,735 for the twelve months ended March 31. This compares with £140,705 for the previous twelve months, and the Board are paying 9 per cent. (including a bonus of 2 per cent.) on the old ordinary shares. In 1935-36 the dividend was 8 per cent., and the present one is the highest yet paid.

South Atlantic Record

THE newest four-engined Farman landplane added to Air France's South Atlantic fleet stationed at Dakar—the re-christened *Ville de Dakar*—has again beaten her own record for the return flight across the South Atlantic from Natal. On her last week's homeward trip she covered the distance in 14 hours one minute against her previous record of 14 hours 27 minutes made on September 27. She has now established new records in both directions. Her speed between Natal and Dakar on her record journey last week was 137½ m.p.h.

The Travelling Exhibition

DURING November the Imperial Airways exhibition train will be visiting nine towns. Earlier this week it was at Bradford, while on Saturday and Monday it will be in No. 4 Bay at the Sheffield passenger station.

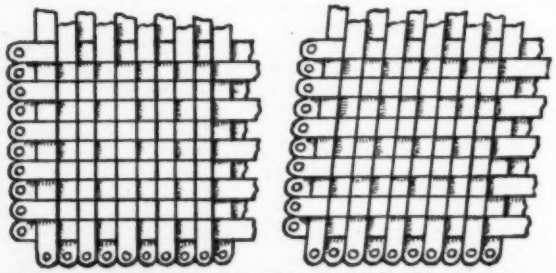
Other visits will be made as follows, the dates given being those on which the public is allowed to look over the exhibition: Derby, Nov. 10 and 11; Nottingham, Nov. 13 and 15; Leicester (Belgrave Road), Nov. 17 and 18; Peterborough (North Station), Nov. 20; Cambridge (Tenison Road), Nov. 23 and 24; Norwich (Royal Dock), Nov. 27; and Ipswich, Nov. 30. On the following day the train will return to London and be on show there.

DE-ICING BY BRADSHAW

Deformable Matting Scheme to be Tested by Air Ministry

MR. GRANVILLE BRADSHAW'S latest invention applicable to aircraft is a de-icing system utilising a fine-weave metallic matting, which, when deformed by suitable mechanical means, in turn deforms a large number of suitably shaped minor surfaces.

The matting, which is placed over leading edges, is woven from thin metal strips of flattened oval section. Each little hollow formed is in reality a deformable rectangle so that when the main surface is moved each hollow elongates across two corners and contracts across the other two. This movement causes the four "wedges" at the four corners to force the ice away from the surface.



How the deformable rectangles of the Bradshaw system elongate across two corners and contract across the others.

According to Mr. Bradshaw, the operating stresses are confined to the metallic covering itself, since each strand of metal forces the ice away from its underlapping neighbour. It makes no difference whether the matting be fitted to a concave, convex or a flat surface.

The additional weight is between two and three ounces per square foot of de-icing surfaces plus about 5lb. for the necessary operating crank, clutch and gearing.

Mr. Bradshaw says that it does not appear to matter how fine is the mesh of the matting so long as each strand is fixed at both ends. The matting has been tested with strands as narrow as $\frac{1}{16}$in. with equally successful results.

The ice breaks up into small pieces and tests indicate that both thin and thick ice are equally easily removed.

It is possible to waterproof the matting by packing with rubber (moulded on) or it may be doped on both sides with rubber and cleaned off on the front. Arrangements have been made for the Air Ministry to test the device. A modification of the scheme is being developed for airscrews.

THE IMPERIAL AIRWAYS DISMISSALS

Questions and Answers in Parliament : Mr. Woods Humphery's Reply

SEVERAL Members of Parliament have asked questions in the House concerning the dismissals of pilots by Imperial Airways, and lengthy, but somewhat non-committal answers have been given by Lt.-Col. Muirhead, the Under-Secretary of State for Air. Mr. G. E. Woods Humphery, managing director of Imperial Airways, has also issued a statement, and this is given in full below.

Mr. Mander asked, on October 27, the reasons for the dismissals (Answer : The matter lies within the commercial discretion of the company, subject to observance of the Fair Wages Clause and to obligations set out in the Air Mail Agreement), and whether these dismissals were due to the fact of their membership of a "particular organisation" (A. : No specific assurance could be given).

Mr. Perkins, who is, incidentally, joint vice-president of B.A.L.P.A., gave some details of the dismissals and also mentioned the fact that the pilot of the ill-fated *City of Khartoum* had also been dismissed since the accident enquiry, during which he gave "detrimental" evidence (A. : That question raises a number of new subjects).

On the following day Mr. Perkins returned to the fray. He spoke of the dissatisfaction which existed among pilots, explained the objects of the Association (which were outlined in *Flight* of October 14), gave the names of the more important officers and said that 80 per cent. of this country's transport pilots and 79 per cent. of Imperial Airways' pilots supported this Association.

He said the Imperial Airways had refused the right to collective bargaining and that there had been some "very curious" dismissals—including that of Mr. Wilson, who was in charge of the Short *City of Khartoum* when this machine crashed two years ago at Alexandria through fuel shortage. He suggested that Mr. Wilson had been dismissed because he "opened his mouth too wide" at the resulting enquiry. The two pilots, Messrs. Rogers and Lane Burslem (the B.A.L.P.A. chairman), who had suggested the discontinuation of the Budapest service during the winter, were also dismissed, though the service had, in fact, been closed down.

Imperial Airways, he said, had done everything in their power to break the Association and had reduced the pilots' wages just when the Company's dividend had been increased from 8 to 9 per cent.

Finally, Mr. Perkins criticised the equipment used and said that, with one or two exceptions, none of the machines were fitted with blind approach equipment, with de-icers or with spare radio sets. The machines used on the London-Paris service were "obsolete" and the European services were the "laughing stock of the world."

The Association had tried to negotiate with Imperial Airways and were now appealing to the Government and asking for an impartial enquiry into the whole position.

Mr. Mander then enlarged upon the fact that a matter of public policy was involved.

Lt.-Col. Muirhead again explained that the Government could exercise no direct control over the Company, and stated that Imperial Airways were not opposed to the principle of collective bargaining, and that there had been no question of victimisation. He could not accede to Mr. Perkins' request for an investigation.

IMPERIAL AIRWAYS' STATEMENT

IT is stated that there have been ten dismissals of our pilots, and it is implied that they are due to membership of the British Air Line Pilots' Association. There have actually been seven pilots' contracts terminated, not ten, and the reasons are various. It may, however, be stated that three of them have never flown in command of the Company's aircraft, their instruction not having been completed. Unfortunately, disclosure of the reasons for the dismissals seems impracticable, although they are, in our view, such that no exception could be taken against them if they were disclosed. No one will question the vital need for strict discipline in a service such as ours. It can in any case be stated definitely that their membership of the Air Line Pilots' Association had nothing to do with the termination of their contracts.

It is stated that the Company has refused any form of collective bargaining. This is not the case. The Company is not in the least averse to the principle, and, in fact, has already concluded an agreement with the Wireless Operator's Association in respect of their terms and conditions of service, and has a large number of employees who are members of Trade Unions.

We do, however, want to ensure that the organisation with which we bargain is truly representative of our employees. The Air Line Pilots' Association has only been in existence for four months and, as far as I am aware, has not been recognised by any company. It does not appear to represent the views of *our* navigating officers. In case there should be any doubt on the subject, there is another body, the Guild of Air Pilots and Navigators, which has been in existence many years, which may be regarded as the representative body on the professional side.

There is evidence that most of our older pilots prefer direct contact with the company, rather than through an association. There has always been machinery for pilots to represent their views directly to the Board and to the Management, and this machinery has recently been extended and modified in view of the extension of our operations.

On the question of remuneration, the pilots on the Empire services operating from Hythe receive a minimum of £975 to £1,525 per annum, according to length of service, qualifications, etc., plus their food and keep while out of England. On the European services, the remuneration ranges, in round figures from a minimum of £500 to £1,500 per annum, according to experience, licences held, length of service and type of aircraft flown. We desire to employ pilots of the highest qualifications and experience, and the rates of pay are at least commensurate with those paid by good employers of professional men of similar skill, experience and responsibility in somewhat similar employment.

The Equipment Question

The next grievance, that in regard to equipment, is curious. Mr. Perkins infers that the aircraft are inadequately equipped and that some are unsuitable for operation in winter. The aircraft have certificates of airworthiness issued by the Air Ministry, and are operated in accordance with the Air Navigation Directions and under the constant supervision of the Aeronautical Inspection Department. The next complaint is that the aircraft employed on the London-Paris route are obsolete. We agree that they have been in use some years, but they are still as airworthy as when they were built, and are easier to fly and more comfortable than later and faster aircraft.

Mr. Perkins charges the Company with lack of foresight, whereas the facts are than in 1933 the Company submitted a memorandum to His Majesty's Government, asking for the Government's decision on the policy that was to be followed in regard to civil air transport after the expiry of the existing agreements in 1937-9. The Company's decision in regard to the ordering of new aircraft was obviously dependent upon which of the three alternative policies the Government decided to follow :—

(1) Continuing assistance of the existing lines, with air mail being carried on a surcharge basis; (2) giving no further assistance and allowing commercial air transport to fend for itself; or (3) the adoption of the Empire Air Mail Scheme, under which all mail would be carried by air on a non-surcharge basis.

Until the Government had decided, it was impracticable for the Board of Directors to specify what aircraft would be required.

Considerable time elapsed while the Government considered the various alternatives, doubtless on account of the need to obtain decisions from the other self-governing parts of the Empire. The Government's policy was announced in December, 1934, but the Board had already given to the builders instructions to proceed with Hannibal replacements for the European services in the previous September. Unfortunately, the delivery of these aircraft is already over a year overdue, and still there is no immediate prospect of delivery. The delay can be attributed to the re-armament programme.

The whole of the commercial risk of the services operated by Imperial Airways is carried by the shareholders, and the criticism of lack of vision does inadequate justice to the directors' steadfast purpose in concentrating on the Empire Air Mail Scheme, and converting it from a project into a reality. The policy in regard to European services is inextricably interwoven with the problem of Empire services. This scheme is unquestionably the greatest step forward in postal development since the introduction of the penny post and will give immense benefits to the Empire, and will promote its consolidation and unity.

To carry out this programme Imperial Airways needs the support of the Press and people of this country and of the Empire.

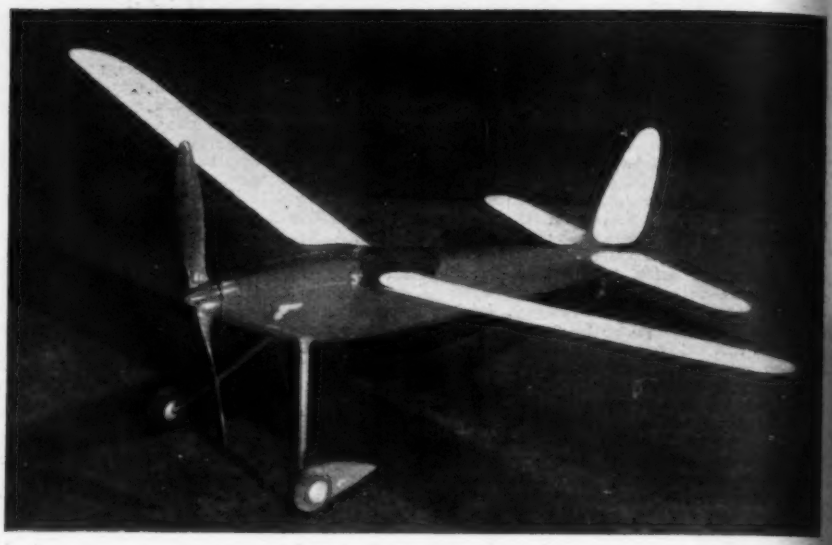
G. E. WOODS HUMPHERY.

[Editorial opinion on the subject may be found on the first page of this issue.—ED.]

MODEL AIRCRAFT

Machines and Materials on Exhibition : A Beautifully Constructed Non-scale Model

By M. R. KNIGHT



Even the camera, which can so often transform good workmanship into bad, and *vice versa*, cannot disguise the perfection of form and finish which characterises Mr. E. W. Evans's monoplane, described below.

On Show

THE Society of Model Aeronautical Engineers was responsible for a most effective display at The Model Engineer Exhibition, recently held at the Horticultural Hall, Westminster. The centre piece was a superb example of the flying scale-model, a tapered-wing Hornet Moth constructed to a scale of 1in. to 1ft. by Mr. H. J. Towner (Brighton D.M.F.C.). Beautifully constructed, attractively finished in cream and white, and possessing fine flying qualities, it perfectly demonstrates what a flying scale-model should be like, and all too frequently is not. There was also an excellent Leopard Moth to the same scale by Mr. S. R. Crow (Blackheath M.F.C.). This model has recently captured the hand-launched and rise-off-ground records in its class with flights of 62.18sec. and 98.35sec. respectively.

Duration types included the very fine shoulder-wing model with which Mr. R. N. Bullock (Blackheath) secured for Great Britain second place in the 1937 Wakefield contest, a similar type with which Mr. E. Chasteneuf (Blackheath) obtained the leading place in the British Wakefield trials, and a successful "Wakefield" class of monocoque model by Mr. R. Copland (Northern Heights M.F.C.).

Marine activities were represented by Mr. H. E. White's twin-motored flying-boat *Goose*, sister (or, more accurately, daughter) ship of *Ganda*, which was recently described and illustrated on this page. Mr. A. E. Brooks' high-wing *Skyrocket*, with inverted 18 c.c. Comet motor, spread its 7ft. 6in. wing-span protectively over the smaller exhibits.

Elsewhere in the exhibition were Mr. R. J. Trevithick's 3ft. span parasol with 1.75 c.c. two-stroke, which it is hoped to describe in a future issue, and the beautiful shoulder-wing monocoque model by Mr. E. W. Evans (Luton D.M.A.S.), which won the prize offered by Mr. D. A. Russell for the best flying model in the show; it is described and illustrated on this page.

Proprietary Exhibits

THE *pièce de resistance* of the stand occupied by Premier Aeromodel Supplies, 2a, Hornsey Rise, London, N.19, was Mr. C. A. Rippon, pioneer modellist, demonstrating the ease with which the firm's cabin low-wing *Cruiser Pup* beginner's model can be built. Static exhibits included the Cleveland flying scale-model kits, sundry models of free-lance design, completed and in kit form, and an unparalleled range of materials and accessories, including plastic wheels.

Petrol-craft, motors and accessories were strongly featured on the stand of the Model Aircraft Stores, 127b, Hankinson Road, Bournemouth. Mr. A. E. Brooks' latest product is the *Comet III*, a 58in. high-wing monoplane designed specially for the 2.31 c.c. Spitfire. His *Comet II*, a robust 6ft. cabin high-wing, now fitted with the new popularly priced 6 c.c. Challenger, is the present holder of the British petrol duration record of 16min. 25sec., achieved by Mr. A. T. Fraser early this year. The largest model of the series is the *Skyrocket*. The S.M.A.E. has wisely ruled that all petrol models flown under its auspices shall be covered by a third-party insurance, and the Model Aircraft Stores has carried its activities to the length of sponsoring an excellent insurance scheme providing cover to the extent of £2,500 for a modest annual outlay.

The hugely popular "Skybird" non-flying scale-models of Messrs. A. J. Holladay and Co., Ltd., 3, Aldermanbury Avenue, E.C.2, were displayed, and included the Hendon and the Spitfire. There was also a Skybird Bristol 138, altitude record-holder on the stand of the Royal Air Force.

A De Luxe Monocoque Monoplane

THE shoulder-wing monoplane by Mr. E. W. Evans, shown at The Model Engineer Exhibition, combines in a truly remarkable manner modern conception in design, structural ingenuity, superlative workmanship, and first-class flying qualities. One is not surprised to learn that 1,000 hours were spent on its production.

The fuselage is formed from three laminations of balsa sheet, $\frac{3}{32}$in. in thickness. Two layers of strips $\frac{1}{4}$in. wide run spirally in opposite directions, and the third layer runs longitudinally. Thus risk of the devastating effects of a fractured rubber motor is practically eliminated. The monocoque shell is painted dark blue, rubbed down, and finally given a high gloss by means of a polishing compound. A low-drag semi-cantilever undercarriage is fitted, with the adjustable-tension mechanism concealed in the fuselage.

The manner in which the slightly-tapered wing halves are arranged to tumble away from the fuselage in the event of encountering a blow is ingenious in the extreme. No wire saddles and rubber retaining bands for Mr. Evans! Two wooden dowels projecting from each side of the fuselage plug into cleverly shaped wire grips in the wing interior, which allow them to slip out in emergency. Tiny celluloid inspection panels are provided to ensure that the dowels are correctly positioned. A ramp fitting connecting the front and rear dowels enables the incidence of the wings to be varied. The faired wing-roots are faced with cork friction pads to minimise risk of damage to themselves or the fuselage. The wings are covered with clear doped white jap silk.

A special contrivance enables the rubber skeins to be rapidly inserted in the fuselage. There are five of them, with a gear box working in an oil-bath, and held in place by flexible clips. Thus the risk of airscrew damage is lessened. The airscrew is of balsa, with bamboo reinforcement of the tips and leading-edge. A free-wheel device which has never failed to operate is concealed in the airscrew spinner. There is a rubber-tensioner of the clutch type.

The tailplane and fin are covered with white jap tissue, and are attached to the fuselage by the same dowel and wire clip arrangement as is employed for the wings. Instant and positive alteration in trim is achieved by means of eccentric bamboo pegs.

The machine is to the 1937 Wakefield, or "8/200" specification. It has a wing-span of 47in., a wing area of 207 sq. in., and the total weight is 10¾oz. With a power run of 110sec., the average duration in non-soaring air is 2½min., and the ceiling 200ft. In the Wakefield trials, without encountering thermal currents, it averaged 136sec., thereby securing 15th place. The best flight so far achieved was one of approximately 15 min., in the course of which it travelled 6½ miles, was lost, and eventually recovered undamaged.